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ELECTRIC RAILWAY TRACTION

A Supplement illustrating and describing developments in Electric Railway Traction is presented with each copy of this week's issue.

Railways and the Ideal Home Exhibition

TO the average man the only connection between railways and an "ideal home" is that the former are expected to carry him to the latter from his place of business in the minimum possible time and with the maximum of comfort. The British main line railways astutely realise that there is more than the daily transport of the bread-winner to be considered, and in their combined stand at the Ideal Home Exhibition now being held at Olympia they have made a point of featuring the attractive facilities for household removals by means of door-to-door transport in containers. By this method the whole of the furniture and effects can be moved quickly, safely, and cheaply from the old home to the new, and the railway company concerned carries through the whole work including packing and unpacking, and laying linoleum and carpets. Furthermore, members of the household whose effects are being moved by this railway service are allowed reduced rates for travel to their new home. Naturally, details of passenger facilities for both regular and holiday travel are also well in evidence, and a wide range of literature is available at the stand inside the Addison Road entrance to Olympia. Transport also features in the G.P.O. exhibit which includes a sound-film dealing with the travelling post offices on the London-Aberdeen night-mail trains.

Preliminary Railway Returns

The preliminary returns relating to British railways in 1935 which have recently been issued by the Ministry of Transport show that traffic receipts increased faster than the expenses, so that the operating ratio improved from 81·49 per cent. to 80·8 per cent. In the total railway receipts of £157,700,000 there was an advance of £2,121,000 or 1·36 per cent., whereas in the railway expenditure of £127,400,000 the increase was only £617,000 or 0·49 per cent. Passenger train traffic produced £70,000,000, an improvement of £1,355,000 or 1·94 per cent., and to secure this an addition of 2·4 per cent. to the passenger train mileage was made. Noticeable in passenger train receipts are the increases of £218,000 or 7·07 per cent. from first class ordinary passengers and of £1,032,000 or 2·74 per cent. from third class ordinary passengers, accompanied by a decrease of £167,000 or 2·02 per cent. from parcels under 2 cwt. This parcels decrease is attributable to the competitive parcels scales introduced by the Post Office last July. In the goods train receipts of £86,200,000 there was an increase of £730,000 or 0·85 per cent., secured by an increase of 0·60 per cent. in freight train mileage. Ancillary businesses brought in a net profit of £600,000 in 1935 comparing with £614,000 in 1934. Net revenue rose from £32,255,000 in 1934 to £33,700,000 in 1935.

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The Week's Traffics

For the first quarter of 1936 the four main line companies publish total traffic receipts of £35,461,000, an increase of £938,000 or 2·72 per cent. in comparison with the corresponding period in 1935. This increase is made up as follows: £117,000 from passenger trains, £397,000 net from merchandise, and £424,000 from coal. Earnings for the past week showed an improvement of only £41,000, compared with one of £116,000 for the previous week, and the percentage increases for the year to date are lower for each company than they were at the end of the 12th week.

	13th Week				Year to date	
	Pass., &c.	Goods, &c.	Coal, &c.	Total	Inc. or Dec.	
	£	£	£	£	£	%
L.M.S.R. ..	+ 3,000	+ 20,000	+ 3,000	+ 26,000	+ 429,000	+ 3·06
L.N.E.R. ..	+ 4,000	+ 15,000	− 5,000	+ 14,000	+ 307,000	+ 2·94
G.W.R. ..	+ 3,000	+ 9,000	− 3,000	+ 9,000	+ 139,000	+ 2·42
S.R. ..	+ 1,000	− 7,000	− 2,000	− 8,000	+ 63,000	+ 1·47

Mersey Railway traffics for the first quarter of the year show an improvement of £1,036. London Transport takings for the 39 weeks amount to £21,166,800, an increase of £399,200.

* * * *

Fuel and Liberty

We have drawn attention from time to time to the activities of the organisation known as PEP (the Political and Economic Planning Group) and our comment on the group's report on the British coal industry, which we made in our issue of March 20, has drawn from an organisation entitled the Liberty Restoration League a request for some notice of a leaflet it has published entitled "A National Fuel Policy," which sets forth views in direct opposition to those of PEP. As the Liberty Restoration League points out, the policy of PEP accepts as inevitable the present shrunken demand for our national fuel and envisages a still further shrinkage. The League on the other hand puts forward a case for a much greater use of coal, of which Great Britain possesses an inexhaustible store and upon which Britain's former industrial and maritime supremacy was reared. The case is concisely and clearly put and shows how the safety of these islands would be jeopardised by the application of "oil sanctions." It is an alarming prospect in these days of wars and rumours of war. Nevertheless all the nostrums,

whether of so-called Liberty Restoration Leagues or Political and Economic Planning Groups, neglect the root cause of war, which is the competition between industrialised nations for foreign markets upon which to dump the surplus output of their prolific industries. It is odd that the obvious solution seems so elusive. It is, of course, to increase internal purchasing power up to the extent necessary to enable the peoples of each country to buy the whole product of their own industries, or the surplus of other countries which they may wish to have in exchange for the true surplus of their own.

* * * *

Railway Benevolence

On another page this week we report the evidence put forward by Sir Robert Horne, speaking at the anniversary dinner of the Railway Benevolent Institution, to support his claim that the railways were the great philanthropists of the country. It is satisfactory to notice that, in addition to their beneficence to the general public in such matters as high speed trains, luxury travel and, as the speeches at the dinner proved, an inexhaustible source of humorous anecdotes, the railways are equally generous in their internal dealings. Particularly striking in the affairs of the Railway Benevolent Institution during 1935 have been the very generous contributions from Ireland, where the Great Southern Railways contributed £2,123 and the Great Northern £224. The Great Northern Railway, moreover, in the person of its General Manager, Mr. J. B. Stephens, provided the Chairman of the Management Committee of the institution's funds, to whose wise administration Sir Robert Horne paid a special tribute. It would seem then that, while, as Mr. J. Bromley said in his speech, railways have changed in many respects since the days when uniforms were few and exiguous and the station staff was measured therefor (as he asked us to believe) by an official with pencil and notebook at the window of a non-stop train, railway benevolence has remained as an unalterable and pervading spirit.

* * * *

Improving the West Coast Service

An important improvement of the afternoon service from London to Scotland is announced by the L.M.S.R. to take effect with the introduction of the early summer timetables on May 4 next. As detailed on page 672 of this issue, the Midday Scot is to resume the departure time which for so many years prior to the war was associated with the north-bound "Corridor." Leaving Euston at 2 instead of 1.30 p.m., it will pick up the difference of 35 min. in running, and it will still reach Glasgow at 9.35 p.m., the overall time of 7 hr. 35 min. being the fastest ever yet tabled between the two cities. By carrying the Aberdeen portion through to Carlisle instead of detaching it at Crewe, Perth will be reached at 11.28 p.m., 42 min. earlier than hitherto (to Stirling and Perth), a total acceleration of 72 minutes. Not only so, but the express which will still run from Euston at 1.30 p.m. will be so speeded up as to cut the journey time to Preston by 34 min. and to Barrow by 40 min. The Royal Scot is to reach Glasgow in $7\frac{3}{4}$ hr., by an acceleration of 10 min., but will now yield its supremacy in overall time to the Midday Scot; the up Royal Scot will continue to run non-stop from Carlisle to London, and to take 7 hr. 40 min. from Glasgow to Euston, while the up Midday Scot will be expedited to make the run in 7 hr. 50 min. Another welcome change is that of starting the up Ulster Express at 7 instead of 5.48 a.m. from Heysham, and so allowing travellers a much better night's rest; again 37 min. will be picked up in running, chiefly by the excision of stops, and Euston will be reached only 35 min. later than before, at 11.35 a.m.

High-Speed Business Travel

In most countries the railway facilities provided for a business man to travel from provincial cities to the capital for the transaction of business, and to return the same day, are superior to any similar facilities in the opposite direction. Germany, for example, has her fleet of high speed diesel railcars reaching Berlin by midday from cities as far away as Cologne, Frankfort, and Munich—over 400 miles journey in the last-mentioned case—but from Berlin it is only Hamburg which can be reached at similar high speed by the Berlin business man travelling there and back in the day. To this general principle Great Britain is no exception. Mile-a-minute trains such as the Mancunian and Merseyside Express of the L.M.S.R., the Silver Jubilee and the Leeds "Breakfast Flyer" of the L.N.E.R., make possible fast journeys from the provinces to London in the morning, with similar return facilities at night; but the only really high speed service of a comparable order in the reverse direction is the Bristolian of the G.W.R. As pointed out elsewhere in this issue, the provision of a through portion for Edinburgh on the 7.25 a.m. from King's Cross will make it possible for the London business man to travel to the Tees or the Tyne and return the same day—an opportunity hitherto denied him though for many years past open to his Teesside and Tyneside counterparts—but a later start and higher speed would render the new service considerably more attractive. And why not a high speed morning service from Glasgow to London, returning in the late afternoon?

* * * *

Railway Wages

The possibility of a temporary settlement with the railway employees on the claim for restoration of earnings and conditions of service existing before the National Wages Board decision of March, 1931, is brought appreciably nearer by the joint announcement published last Friday. Negotiations on this question have been proceeding for some time between representatives of the companies and of the three railway trade unions, and following a joint meeting on March 25 the executive committees of the unions have arranged for certain proposals then under discussion to be considered by their governing bodies where necessary. These proposals are that as from the first full pay day following July 1, 1936, the deduction of $2\frac{1}{2}$ per cent. from all earnings, at present operating under the agreement of August 10, 1934, shall be replaced by a deduction of $1\frac{1}{4}$ per cent. from all earnings. Conditions of service as determined by National Wages Board Decision No. 119 (of March 5, 1931) to continue in force. These arrangements are to operate for a period of twelve months and thereafter until varied by agreement or by decision of the Railway Staff National Tribunal. Similar proposals affecting railway shopmen have been under discussion by the National Railway Shopmen's Council. If all these proposals are accepted by the governing bodies concerned it will mean an addition of some £1,100,000 to the pay roll in a full year. Mr. William Whitelaw, Chairman of the L.N.E.R., is not in favour of the proposed concessions, although joining with the other companies in putting them forward.

* * * *

Air-Conditioning in the British Empire

An Empire on which the sun never sets might, one would suppose, afford many interesting examples of the comfortable modern railway carriage equipped with plant for cooling the air reaching the inside. Such plant, while being the latest of the aids to passenger comfort, has now been available for several summers, and there has been ample time for instances of its use to become

numerous. The truth respecting this matter is, however, a little surprising, for, in the British Empire instances of properly air-conditioned railway carriages are still very rare. In the United States many thousands of cars have been air-conditioned during the past few years—over 3,000 were added to the total number in 1935 alone—but in the British Empire—even in Canada where there is close contact with the States—a beginning is only now being made. As was mentioned recently in THE RAILWAY GAZETTE, the Canadian Pacific Railway has just decided on a programme of air-conditioning. In this issue we publish an article showing that Australia has gone a little further. Two cars on the Victorian Government Railways were equipped with an English air-conditioning plant by J. Stone & Co. Ltd. as an experiment, and were put into service some while ago. They were the first air-conditioned cars to operate in regular service on a revenue earning basis in the whole of the British Empire. Another 26 equipments are now to be acquired and we give a full description of these further on in this issue.

* * * *

Complete Air-Conditioning

Statistics given in the March issue of the *Railway Electrical Engineer* show that 1,799 out of the 3,349 cars to be completely air-conditioned in the U.S.A. in 1935 used Freon as the refrigerant, the alternatives (ice, water, and methyl-chloride) being used in 989, 549, and 12 cars respectively. Freon is thus the most extensively used refrigerant in the home of railway air-conditioning, and has been chosen for the Australian application mentioned in the foregoing note. If a distinction is to be drawn between carriages which are equipped for completely controlling air-condition, and those equipped for partial control, the cars to be equipped for the Victorian Government Railways must be classed as cars with only a partial control, for apparatus to humidify the air in cold weather (when it will be electrically heated) though manufactured by J. Stone & Co. Ltd., will not be provided in this instance. The omission would be an unfortunate one in a climate providing extreme cold, for, in the absence of moisture, considerably more energy must be expended in heating the air to produce the same feeling of warmth. Moreover, the passengers themselves are quickly robbed of their moisture content by dry hot air, and they tend to become inordinately thirsty. In Australia, however, the occasions for heating the air are few, and, in any case, the temperature elevation required is so small that the ensuing reduction in the relative humidity is insignificant.

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Fishplates

From the introduction of railways until the year 1847 rails were laid without any rigid connection between them endways, and were simply placed one against the other in a chair made of extra size for the purpose, or tapered, with overlapping ends, as in the William Losh and George Stephenson patent of 1816. In 1847 the system was introduced of uniting the rail ends by fishplates to secure vertical strength, and both the method and the name remain with us substantially unchanged. It appears, however, from inquiries which reach us from time to time that considerable uncertainty exists as to the origin of the word. As long ago as 1666 (and probably earlier) the term fish was used in nautical language for a splint used by sailors to mend masts and spars. It is fairly certain that this meaning of a splint was intended when, in 1847, W. B. Adams patented the fishplate for strengthening a rail joint. His patent specification is the first known use of the complete word "fishplate." The French use their own word for a splint (*une éclisse*) for a fishplate. It has been suggested that the term fish was applied because the early fishplates were convex on one side, and thus a pair of them roughly resembled a fish cut in two. Although this may possibly have been the origin of the nautical term, it is almost certain that the railway word was derived from shipping practice and not direct from any resemblance to a fish.

* * * *

Welded Railway Structures

At an informal meeting of the Institution of Civil Engineers the other day, the subject of welding in constructional and repair work was discussed. Mr. John Miller, Engineer, North Eastern Area, L.N.E.R., was well qualified to open the discussion, as under his supervision probably more welding of railway structures has been undertaken in this country up to date than under any other railway engineer. Reference has been made from time to time in these pages to the work carried out under Mr. Miller, and there is no doubt that he has been able to save certain structures which had become so badly corroded that otherwise they would have had to be entirely replaced. During the discussion, the question arose of stresses induced in structures by the intense heat generated in welding, and the general lack of precise knowledge on this subject, at any rate so far as this country goes, was remarked upon. In this connection we would draw attention to an article on page 652 by Mr. Otto Bondy, from whose pen numerous previous articles on the application of welding to railways have appeared from time to time in our pages. The country which has developed the art of welding to the highest degree is probably Germany, and thanks to Mr. Bondy we have been able to keep our readers informed of all the developments in that country as they have occurred. It is certainly a remarkable thing that already there are more than 200 all-welded under-bridges in successful service in Germany.

* * * *

Locomotive Replacements

A correspondent writing in the columns of our American contemporary, the *Railway Mechanical Engineer*, states that the almost complete cessation of steam locomotive orders in the United States cannot be due entirely to the financial conditions of the railways, as the net earnings of railways in other countries have also shown a marked decline compared with more prosperous days. Nowhere, however, has the renewal of the locomotive stock been neglected to the same extent as in America. In Great Britain approximately 4,500 new steam locomotives were placed in service by the four main lines during the 10 years 1926-1935 inclusive, and this represents about 22 per cent. of the present locomotive stock of those railways. True this percentage of replacements is still somewhat below normal, but it appears huge by comparison with the 7·8 per cent. credited to the U.S.A. during the same period. One thing that has been done in Great Britain, the writer considers, might be applied with profit in America, namely, the consolidation, or grouping, of railways; this has brought about a greatly improved motive power situation by decreasing both the total number of locomotives and the number of different classes. Complete and rigid standardisation of locomotive types is neither possible nor desirable; nor would any well-informed critic advocate consolidating all railways into one concern, whether under private or Government control, but it is apparent that the highest economic efficiency cannot be obtained by the present organisation in America, involving some 50 large systems, all purchasing engines in small numbers and with frequent alterations in design.

Agreed Charges

REFERENCE has previously been made in these columns to the value of the power conferred on the railway companies by the Road and Rail Traffic Act, 1933, to enter into agreements, with the sanction of the Rates Tribunal, for the conveyance of merchandise at agreed charges. There are now more than 230 such charges in operation, all of which are on a package, tonnage or animal basis, with the exception of that relative to F. W. Woolworth & Co., which is based upon a percentage of the firm's annual turnover. In practically all these cases the traders took the initial step of asking for the application of such a charge to their traffic, and the commodities now conveyed under this method range from groceries and provisions, confectionery and tobacco, boots and shoes, furniture, hardware and china, to live pigs and dead rabbits. The companies are now bringing the advantages of this method of charging to the notice of large traders, and a further increase in the number of such charges may be expected; owing to the detailed investigations involved, however, progress will naturally be slow. The number of applications for agreed charges which have been dropped after investigation by the companies is more than treble the number of those in operation. Unless the agreed charge principle is used with considerable care, there is a danger that the repercussive effect on the general level of railway rates may ultimately prove serious.

Theoretically, an agreed charge is based on the summation of a trader's transport costs during a representative period, divided by the number or weight of the goods despatched. In the case of a trader whose goods are entirely rail-borne, such a calculation is simple, although frequently laborious owing to the number of consignments involved, but the matter is decidedly more complicated when a trader forwards a proportion of his traffic by road as well as rail, not to mention other forms of transport. In such cases he is required to furnish full particulars of the traffic so forwarded, together with the appropriate charges, so that the companies may decide whether, in their judgment, the rates paid are on an economic basis. After allowance has been made for any rates considered to be uneconomic, a weighted average covering both rail and road traffic is calculated, and, if considered desirable, an agreed charge is offered, which may be less than it would be if the whole of the traffic were rail-borne. Occasionally, however, traders forward the major portion of their traffic by road, and its inclusion, even at rates which the railways consider economic, sometimes makes a material reduction in the level of the average charge. These cases naturally receive very careful consideration; while the companies obviously want the additional traffic, they must have regard to the immediate effect of the quotation of such a charge upon the business of competitive traders who place all their traffic, or a great part of it, on rail, as well as to the probable ultimate effect upon the general level of railway rates. In fact, in a number of such cases the companies are not prepared to offer a sufficiently attractive figure, and the application is declined.

A further point in connection with agreed charges is that although they accurately reflect the extent of the business at the date of the original test, the trader may extend the range of his marketing operations during the currency of the agreement, to the disadvantage of his competitors. It is true that the subsequent test which is made when the charge becomes due for renewal will correct this, but the trader generally secures the advantage of the lag which is bound to occur. The principal advantage of an agreed charge to a trader is that it enables substantial economies to be effected in clerical and accountancy costs, and enables him to offer goods delivered within a large area at a charge inclusive of carriage. Experience has shown, however, that this method of charging is not suitable for all types of business; it is generally more advantageous, for example, for small traders to rely upon the quotation of exceptional rates, except in those cases where they despatch commodities to a fairly confined area. Such traders suffer no undue disadvantage in having their traffic charged in this manner, as traders forwarding large consignments of traffic have for many years been able to secure more favourable rates than those forwarding small lots. The railways also have been able to save clerical and accountancy costs, but these have been partially nullified by the necessity of making detailed tests at regular intervals to ensure that any variation in weight or destination is reflected in the adjustment of the agreed charge. Thus, while there seems every likelihood of the agreed charge principle becoming a permanent and increasingly important feature of railway charging practice, there is unlikely to be any rapid increase in the number of such charges owing to the many considerations involved.

* * * *

Argentine Election and the Railway Situation

IN the Argentine Chamber of Deputies there are 152 seats, for half of which members are elected every two years. Polling has recently taken place in Buenos Aires and in the majority of the 14 provinces to replace members whose term of office has just expired. The results announced to date have been somewhat surprising, and indicate a decided swing of the electoral pendulum towards the traditional Radical party, of which Dr. Marcelo T. de Alvear, President of the Republic during the period 1922-28, is the leader. His successor (the late Hipolito Yrigoyen) was deposed by the revolution of 1930, the present Government—which followed the virtual dictatorship of General Uriburu—being a coalition of Conservatives and what are known as Antipersonalist Radicals, *i.e.*, those who repudiated ex-President Yrigoyen's policy. Buenos Aires City itself, which elects 32 deputies and has given the Socialists a large majority for many years, has turned Radical, and in the recent elections the latter party polled nearly 190,000 votes against the Socialists' 103,000. The votes of the Government supporters totalled only some 25,000, reflecting the unpopularity of those in authority. The majority of the seats in the Provinces of Santa Fé and Córdoba have also been won back by Dr. Alvear's party, and interest is at present centred on the results of the Province of Buenos Aires, which sends 42 deputies to Congress; this is a Conservative stronghold, but the Radicals will probably triumph in the elections. Whatever the result may be, it is evident even now that the Government supporters will find themselves outvoted in the Chamber by the opposition parties, in which Radicals and Socialists predominate.

Press comment in regard to these results lays prominence on the unpopularity of many measures put in force by the present Government, particularly those of a financial nature, such as exchange control, and the depreciation of the peso. Be that as it may, it becomes more and more evident that the old Radical party will come back to power before long. A disquieting feature in this connection is that the Radicals have been very active in their opposition to measures proposed by the Government for the alleviation of the ills which affect British-owned railway and tramway companies, particularly the Co-ordination of Transport Bills. It cannot be said, however, that the Radical Governments have been altogether unsympathetic

to the claims of foreign investors, and the attitude of the party in the case of the Bills mentioned may have been chiefly due to its desire to oppose any measures suggested by its rivals.

* * * *

Rating of Railways

IN view of the recent decision of the House of Lords on the principles of railway rating it is most important that the true position on this highly controversial question should be generally realised. Erroneous ideas on the subject appear to be prevalent, as exemplified by the following typical extracts from the popular press:—

> The privileged position of the railway companies in respect of both rating assessments and the derating of industrial transport will be vehemently assailed.
>
> It was decided to support a movement by local authorities against the refunding to railway companies of money paid in rates.

There is also a suggestion that amending legislation is necessary in order that the railways may pay a "fair and equitable" share of local rates. The County Councils' Association is reported to be sending a deputation to the Minister of Health, and if it does, the Minister might perhaps read the reports of the Central Valuation Committee and inquire of the county councils' representatives whether they have any intention of dealing effectively with the under-assessment of properties occupied by resident ratepayers. A Departmental Committee appointed by the Government in 1911 reported in 1914 recommending that the local authorities should be relieved of the duty of making valuations for local rates, and in the same year a revenue Bill was introduced containing provisions designed to pave the way for the transfer of the duty of making valuations for local taxation from the assessment committees to the Land Valuation Office. The outbreak of war in August of that year prevented the Bill from being proceeded with. In 1925 a Rating and Valuation Act was passed, one of the objects of which was to "promote uniformity in the valuation of property for the purpose of rates." For the same purpose the Central Valuation Committee was constituted, but unfortunately the powers of this committee were limited to giving advice and it is clear from its reports that uniformity has not yet been achieved; indeed it is well known that throughout the country properties other than those of public utility societies are often grossly under-valued. Undoubtedly on the top of an excessive assessment railway companies have had to bear more than their fair share of the local expenditure because of the under-assessment of other properties. The people who are responsible for this are now suggesting that the railway companies are in a privileged position in regard to local taxation and should not be refunded overpayments covering the period during which the authorities and the Courts have been discussing the question. The Railway Assessment Authority is composed of representatives of the various local authorities and to disentitle the companies to recover overpayments would place a premium on delay in making the railway valuations.

The determination of a "fair and equitable share" would involve a comparison of the railway companies' rates and taxes bills with those of other industrial companies of comparable size in relation to their respective net receipts. The figures in regard to the latter companies are not available because there is no distinct item of rates and taxes in their accounts, which suggests that the amount is unimportant. In making this comparison it would be unreasonable to ignore the provisions of the Local Government Act, 1929. This Act directed the local authorities wholly to exempt agricultural land and buildings from rates (the value of this exemption is estimated at £15,000,000) and to reduce by three-quarters the assessments of industrial and freight transport hereditaments (equivalent yearly rates estimated at £12,000,000 and £5,000,000 respectively). There was no discrimination between the depressed and the prosperous. All were relieved of three-quarters of their rates and, so far as industrial hereditaments were concerned, could do as they pleased with the money. The prosperous ones hardly knew what to do with it. In complete contrast the railway companies had to pay the amount of their exemption into a fund known as the Railway Freight Rebates Fund and distribute the money amongst certain of these industries (agriculture 20 per cent., coal 70 per cent., iron 10 per cent.) by means of rebates on conveyance charges. The colliery companies and the railway companies are alike in suffering from the contraction of exports. The assessments of the first named companies were reduced owing to the fall in the rental value of their works, they were then relieved of three-fourths of their rates, and this was followed by rebates on conveyance charges and tariffs to check foreign competition. It is now proposed that the railway companies are not to have even a reduction of assessment. On the other hand the many millions of money which are to be spent on roads will divert traffic from the railways. The safety of the users of the railways has to be ensured regardless of cost and the companies have to accept for conveyance all classes of traffic the charges for which are controlled, whereas road transport companies can decline to convey goods which would not be profitable. In view of the decisions of the Railway and Canal Commissioners and the House of Lords, it cannot be that in law the amount of the rates the railway companies will be called upon to pay is too low. If it be said that law is one thing and equity is another it can be shown that in equity the amount is sufficiently high even if it be nil.

The exemption of profits of trade is of the essence of the matter. Local rates were originally imposed to meet the cost of relieving the poor and until 1840 personal as well as real property was liable to the charge. Difficulties consequent on the great expansion of industry caused the Poor Rate Exemption Act, 1840, under which personal property was exempted and the entire burden of local taxation placed upon land and buildings. This has borne very hardly upon industries which need a large quantity of land, notably agriculture and railways. From causes it is not necessary to discuss here, the occupation of agricultural land has become less and less profitable and this has led to its being wholly exempted from local rates, farmers now paying on their dwelling houses only. The financial state of railways has also become depressed but instead of being treated in the same way as agriculture it is suggested that they shall continue to carry a burden which the Courts have decided to be excessive. The main question at issue before the Courts was the proportion of the net receipts to be treated as profits of trade which by statute are exempt from rating. This issue arises only in regard to public utility undertakings, such as railways, gas works, and water works, which are valued on the receipts and expenses basis. The point does not directly arise in the rating of other industries and as already stated it would be safe to say that the amount of rates borne by such industries is small compared with that borne by railways and other public utility undertakings.

Procrastination on the part of the Government in enacting that each railway should be valued as a whole instead of in parochial sections has also contributed to the present troubles. Since 1854 each railway undertaking in Scotland has been valued as a whole, but, notwithstanding recommendations of commissions and committees, a similar

method was not adopted in England and Wales until 1930 when it came into being as a result of the Railways (Valuation for Rating) Act of that year. Had the change taken place in prosperous times it would have caused little disturbance and there would not have been the complication due to the provisions of the 1929 Act. It should be borne in mind that prior to the war it was impossible to ensure that the sum of the assessments of the several railway hereditaments did not exceed the value calculated as a whole, even assuming that the numerous tribunals of appeal were of one mind in regard to the allowances to be made from the gross receipts. In other words, everything else being the same, a change from the distinct valuation of parochial sections to a valuation *in cumulo* would of itself cause a reduction of assessment because the application of the former principle resulted in negative rateable values in a large number of areas, and such areas were given notional assessments. Under the parochial system, therefore, the sum of the actual assessments exceeded the value calculated as a whole by the amount of the negative rateable values plus the notional assessments and the rates thereon. As only one quarter of the amount borne by the railway companies is paid to the local authorities the reduction of assessments in question is of serious concern to a comparatively small number of authorities. A much greater difficulty arises in consequence of the provisions of the Local Government Act, 1929, under which the railways were involved in devices for assisting certain industries. The position of railway companies closely resembles that of the agricultural industry and Lord Hugh Cecil's remarks in a letter to *The Times* of March 18 in regard to the latter also apply to the former:—

> The strongest cause of agricultural difficulty is due to Parliamentary action. It is because Parliament has by statutory enactment raised agricultural wages to more than double their pre-war level that the difficulty of paying tithes in some districts has arisen. It is high wages even more than low prices that bear hard on the farmer. I am not objecting to this statutory raising of wages. *But if Parliament in pursuit of a particular policy has disordered the* agricultural *industry and has so caused hardship* to tithepayers, *it is for Parliament to relieve the hardship at the general cost of the community.*

* * * *

Train Resistance at High Speeds

IN our issue for August 23, 1935, there appeared an article by Mr. T. Grime entitled "The Influence of Speed on Locomotive Haulage Capacity and Fuel Consumption" with an editorial comment to the effect that the train resistance figures given in this article were based on a formula which could not possibly be accurate for trains of widely differing lengths and weights at speeds for which the air resistance became an important part of the whole. Now, as might have been expected, we have received a communication from another authority on train performance prediction, and in this the calculations of our contributor are repeated but with different first assumptions as to both train resistance and coal consumption. Our correspondent, The General Electric Company of Schenectady, favours the train resistance formulæ of W. J. Davis, Jr., for which world-wide recognition is claimed, and obtains consistently higher train weights than Mr. Grime owing mainly to the use of the Davis formulæ. The contributor of the original article has replied to the criticism implied in our correspondent's letter by pointing out that if the Davis formulæ be ranked equal in authority with those of Lawford Fry, Henschel, the Baldwin Locomotive Works, the American Locomotive Company and Dendy Marshall, they merely aggravate the uncertainly regarding train resistance by adding to the several figures one might quote, a further figure lower than any of these. For a locomotive weighing 127 tons the various formulæ mentioned, including those of Davis, give resistances varying between 1,832 lb. and 4,100 lb. at 60 m.p.h. and between 2,794 lb. and 5,800 lb. at 80 m.p.h.

Looking through the matter sent to us by our American friends we feel disposed to repeat the criticism inspired by the original article. The Davis formulæ appear to relate to individual carriages, so that for an n-carriage train the resistance is taken to be n times that for a single carriage. We refuse to accept this result except as a first approximation, but at higher speeds it cannot be even a fair approximation, and, when it is remembered that an error of 100 lb. in the resistance figure at 80 m.p.h. means an error of 21⅓ in the d.b.h.p., the folly of making guesses at the resistance becomes immediately apparent. New experimental data must be gathered from track tests carried out at high speeds, and then, with a background of reliable facts to go upon, more reliable deductions might be made concerning the performance of the trains it is actually proposed to run.

Last August there existed in this country no train suitable for experiments at extra high speeds—a fact we deplored. Today we are happy to think that in the L.N.E.R. Silver Jubilee train this country possesses a more useful piece of experimental apparatus than any of her contemporaries. We accord a superiority to the Silver Jubilee train over the Flying Hamburger, the Burlington Zephyr, and others, because it is steam hauled, and because the information most generally wanted just now is information relative to the further high speed possibilities of steam trains. We look forward with considerable eagerness to the publication of dynamometer car records taken with the train, and hope that records will be made with a train of widely differing lengths, as these would enable a more reliable formula for train resistance to be devised, taking into account the dependence at high speeds of the resistance in lb. per ton on the total weight of the train.

* * * *

Fissured American Rails

AS yet the plague of the transverse fissure in American rails shows no sign of diminution, but continues steadily to increase. For some time to come this increase is, presumably, to be expected, as more and more exact methods of detection are evolved; further, little benefit can yet be expected from controlled cooling, for satisfactory methods for its application are only just beginning to be applied in American mills, and the tonnage of rails so treated forms but a minute fraction of the total tonnage of rails laid. Figures on this subject are presented annually to the convention of the American Railway Engineering Association; and the total fissure failures in 1934, which was the year under review at this year's convention, were no fewer than 9,820—an increase of 1,106 over the failures in 1933. Even then this is not an absolutely complete review, for it is confined to those railways which report annually to the convention, though these certainly include all the lines of major importance. Of the total of 9,820, 5,034 of the fissures were "detected" by the Sperry apparatus, and the rails removed before fracture; the remaining 4,786 were rails which broke in service. Since the preparation of these statistics was commenced, the aggregate number of known fissured rails in American tracks has grown to 79,305; this was only until the end of 1934, and by the end of the present year the 100,000 mark will probably have been passed. The cost of this defect in rail renewals alone must have been enormous; when the damage to life and material by accidents so caused has been added, the transverse fissure bill has reached vast dimensions.

PUBLICATIONS RECEIVED

The Stock Exchange Official Year-Book, 1936. London: Thomas Skinner & Co., Gresham House, Old Broad Street, E.C.2. 10¼ in. × 6¾ in. × 3½ in. Pages i–ccxx and 1–3458. Price 60s. net.—This is the third issue of "The Stock Exchange Official Year-Book," which incorporates "The Stock Exchange Official Intelligence" and "The Stock Exchange Year-Book," and is compiled and edited by the Secretary of the Share and Loan Department of the Stock Exchange. It continues to give all the essential information required by investors, combined with the greater ease in handling and reference first introduced two years ago when the publication was remodelled. The present issue contains notices of 45 Government and municipal loans and 344 companies which were not included in the previous issue, but, as many concerns have ceased to exist and been taken out of the book, its bulk is not materially increased. "Fixed trusts," particulars of 56 of which will be found in this volume, are shortly to undergo investigation before a departmental committee of the Board of Trade.

Special chapters in the early part of the volume deal with municipal, county, Indian, Dominion and Colonial, and British and Foreign Finance, and Company Law in 1935. In these chapters are included the results to date of the working of railways in India and of the State-owned railways in the Dominions and Colonies, and also the rates per £1 at which foreign currency figures have been converted into sterling figures. Particulars are supplied, in the chapter on Indian Finance and under the heading of Indian Railways, of the status of Indian railways, their contracts, dates of purchase, &c., and as to the annuities representing part of the purchase price for which several systems have already been acquired by the State. Under the heading "Public Boards" will be found full particulars of the London Passenger Transport Board and of the Northern Ireland Road Transport Board; details of the London Electric Transport Finance Corporation appear under "Financial Trusts, Land and Property."

Statements are given showing the working results from 1926 to 1935 inclusive of the four principal British railway companies and of their investments in transport undertakings. The Foreign Railway Section is comprehensive and contains the latest available information as to schemes of arrangement and negotiations for Government purchase. In the Railways—Dominion and Colonial Section are shown the ramifications of the two great Canadian systems, and the position of the Great Southern Railways Company of Ireland. Towards the end of the book is the Supplement, containing information received too late for classification. In this supplement is included a description of the Railway Finance Corporation. After the supplement will be found the usual particulars relating to stamp duties, trustee investments, the public trustee, income tax, estate duty, &c.

Steam Locomotive Design: Data and Formulæ. By E. A. Phillipson, A.M.Inst.C.E., A.M.I.Mech.E., M.I.Loco.E. London: The Locomotive Publishing Co. Ltd., 3, Amen Corner, E.C.4. 5⅞ in. × 5½ in. × 1¼ in. 444 pp. Illustrated. Price 30s. net.—This is a technical treatise covering in thorough and well-arranged sequence all the principal factors concerning the design and construction of the modern steam locomotive. The author in his preface, rather modestly we think, claims it to be "nothing more than a locomotive engineer's anthology," to bridge the gap between works of a purely descriptive nature and others, which, although of interest to a locomotive engineer, are not strictly confined to the class of machine with which he is principally concerned. In the work before us theory and practice each receive their full measure of attention and adequate space is devoted to what may be termed extraneous considerations such as the stability of the locomotive on the track; train resistance; conditions imposed by the traffic department; permanent way; and other similar matters, as well as to the fundamentals of design, methods of construction, and the mass of data and formulæ that are inseparable from locomotive engineering in its various phases.

The work is divided into twelve chapters, with an appendix, list of plates, and index. The author begins his task by treating such points as tractive force, power, adhesion, and resistance, and the determination of leading dimensions and points of design. He passes from these to a survey of locomotive boiler design and equipment, superheaters, feedwater heating, smokebox, blastpipe and chimney; not the least valuable aspect of this section is the copious manner in which the various points are mathematically treated, and illustrated by means of sectional and other drawings, the reproduction of which leaves nothing to be desired. Maintaining the same high technical standard, the next sections in turn deal with the engine, valve ports and valve gears, compounding and so forth, after which, in Chapter XII, the structural portions covering the frames, springs, tanks, bunkers, and tenders are dealt with at some length.

Much of this material has already appeared in the pages of our contemporary *The Locomotive Magazine* under the same authorship, but in the completed work quite a considerable amount of valuable matter has been added, more particularly the appendix, which deals with ultimate tensile strength and other particulars of materials for locomotive construction as specified by the British Standards Institution. There are some very useful folding plates clearly illustrating varied subjects, including sectional views of complete locomotives, component parts, and load and stress diagrams. As we remarked at the outset the chief value of the book is to be found in the fact that it deals specifically with the technology of the subject and is, in our opinion, one of the best, if not the best, work at present available in which the mathematics, as we may term them, of the locomotive are made the principal theme for consideration. This is most important for those who intend to make locomotive engineering their profession or who for any similar reason wish to make themselves more closely acquainted with the ethics of design; in other words it does not deal so much or so descriptively with the finished product as with the calculations, designing, and other more scientific aspects of the subject. The work is identified almost exclusively with the standard gauge locomotive as found in the United Kingdom, and we confess to a little surprise and some disappointment that it does not cover even briefly the special problems concerned with the design and operation of heavy and powerful locomotives on narrower gauges, problems which are usually more difficult to solve than those in which the standard gauge is concerned. Then again, there is no mention of articulated locomotives although a useful section is devoted to flexibility on curves whilst, of course, centre of gravity, weight distribution, and tractive force are all given their fair of attention. These factors are associated almost inseparably with the articulated form of locomotive.

In these days when it is often found difficult to keep the weight of a locomotive down we might have expected something more regarding the metallurgical side of the subject, and in this connection we note, in passing, that in the section devoted to the lagging of boilers and cylinders where mention is made of some of the materials used for the purpose there is no reference to the tin-foil class of insulating material which nowadays is being extensively used and which is of particular value because of its extreme lightness. We realise, of course, that a line has to be drawn somewhere and that within the limitations of a book of this size something must of necessity be left out, but it seems reasonable to assume that the demand overseas for a work such as this is likely to be considerable and the absence of any material reference to narrow gauge and articulated locomotives may quite reasonably be considered an omission which detracts somewhat from the value of an otherwise very informative and useful work of reference.

We are often asked to advise in the selection of books on the technology of locomotive engineering and kindred subjects and the availability of the present volume will certainly lighten our task in that direction.

THE SCRAP HEAP

The well-known G.W.R. "Bulldog" class 4-4-0, No. 3345, *Smeaton*, has just been broken up at the company's Swindon works after 1,170,839 miles of running. When built, this engine was named *Exeter* and bore the number 3357; during the visit of King Edward VII and Queen Alexandra to the West of England in March, 1902, it was selected to haul the royal train from Newton Abbot to Plymouth, and was temporarily named *Royal Sovereign*. After a resumption of its career as *Exeter*, the engine underwent a second change, to its final title, in 1927, in accordance with the company's policy, of abolishing place names for locomotives to avoid confusion with the destinations of trains.

Railway Directors' Sons Ride in Grand National

Two sons of railway directors rode in the Grand National last Friday. Mr. T. Holland Martin who rode *Evasio Mon* is a son of Mr. R. Holland Martin, Chairman of the Southern Railway Company, and the Hon. A. Mildmay, son of Lord Mildmay of Flete (a director of the Great Western Railway) rode his father's horse *Davy Jones*.

* * *

A guest of the Southern Railway at Southampton to witness the arrival of the *Queen Mary* sends the accompanying verses from the back of a postcard depicting the King George V dock. The author is anonymous but a well known railway official is suspect.

Queen Mary the first in a long bygone age
Thus addressed her attendants with obvious rage :
" By the way you have fought
" You have lost me a Port,
" And, when from this life I sadly depart,
" You'll see the word Calais writ large on my heart."
But now that we live in symbolical times,
And express our ideas in doggerel rhymes,
The good ship *Queen Mary* now shows her regard
For a Port where the times are excessively hard,
And Merseyside folk may see, when they turn,
The word Liverpool aptly writ on her stern.

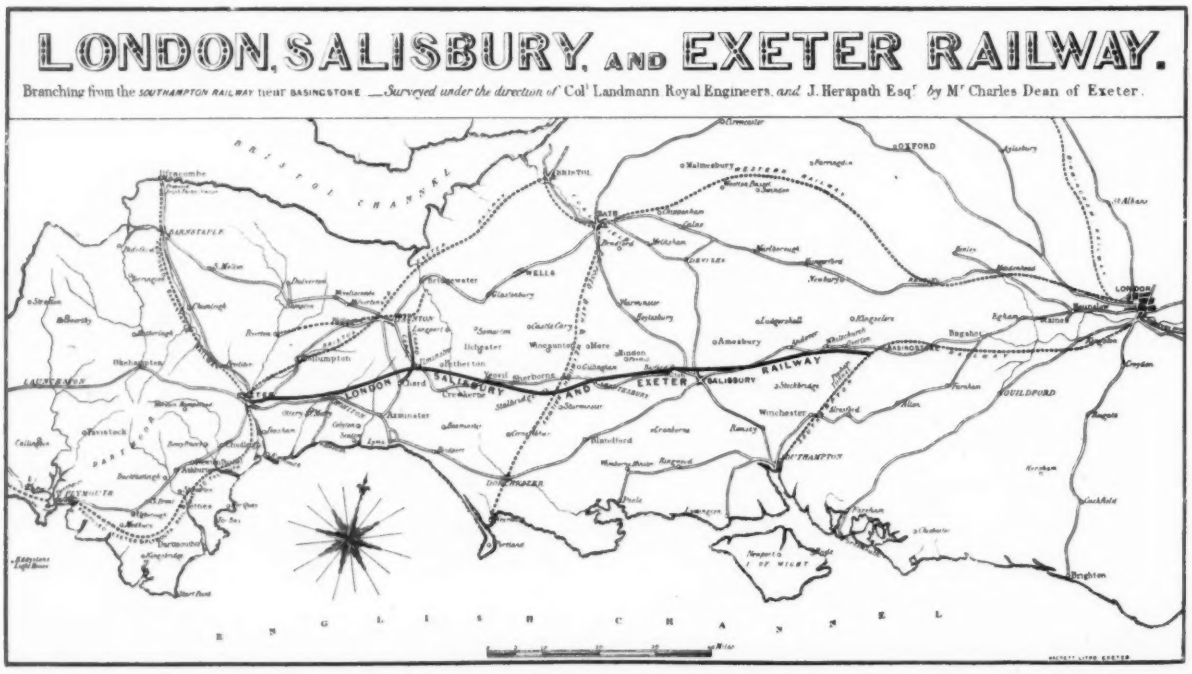
One Hundred Years Ago

Extracts from the April, 1836, issue of "The Railway Magazine" (afterwards "Herapath's Railway Journal") and the oldest constituent of THE RAILWAY GAZETTE

London, Salisbury, and Exeter Railway

Owing to the late time at which the report of this railway reached us, we are unable to enter into the detail of this magnificent work in the manner we could wish. We shall, therefore, merely make an extract from the *Western Times*, which, better than anything we can say will show the favour with which it is regarded by one of the local journals on the line, and therefore the best able to appreciate its merits.—Ed. *R.M.*

London, Salisbury, Exeter, Plymouth & Falmouth Railway.—This magnificent undertaking is progressing with the speed of a locomotive engine, and such is the conviction in the public mind, of its expedience, utility, and general success, that we are informed applications for shares are pouring in from all directions; upwards of 12,000 shares were taken in a few days at Manchester, Liverpool, Birmingham, and Leeds; Sheffield, York, Glasgow, and Edinburgh, have also eagerly shown their unbounded confidence in the success of this improved source of national communication by applying extensively for shares. The government, no doubt, appreciate the advantages they will derive in the conveyance of the mails, troops, baggage, &c., and we understand that to ensure a good working line, they intend sending their own engineers to survey and report upon the line previous to a bill being obtained; but from Colonel Landmann's scientific and practical acquirements, exemplified in the construction of the Greenwich railway, combined with Mr. Charles Dean's local knowledge, this at first sight would seem superfluous, and it only shows the anxious wish of the government to do that which will permanently benefit the country. The railway will run parallel to the city of Exeter, from St. Anne's Chapel to the Depot in the Barnfield, and thence to the New Bason, from whence the lines to Plymouth, Falmouth, and Barnstaple will spring, and will confer advantages on the city of Exeter, which cannot be otherwise than appreciated by the inhabitants at large, and ensure their zealous co-operation.


LONDON, SALISBURY, AND EXETER RAILWAY.
Branching from the SOUTHAMPTON RAILWAY NEAR BASINGSTOKE —Surveyed under the direction of Col.ᵗ Landmann Royal Engineers, and J. Herapath Esq.ʳ by Mr Charles Dean of Exeter.
BRISTOL CHANNEL
ENGLISH CHANNEL
SALISBURY AND EXETER RAILWAY
LONDON AND SALISBURY RAILWAY
BASINGSTOKE AND OXFORD RAILWAY
SOUTHAMPTON
Brighton

Reduced reproduction of a lithographed folding plate which accompanied "The Railway Magazine" a hundred years ago

OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

INDIA

Vizagapatam Harbour

In official opinion it is yet too early to say whether the Vizagapatam Harbour is a successful scheme. The total outlay up to the end of September, 1935, amounted to about Rs. 376 lakhs. The estimated income for the current year is Rs. 8,77,920. Ships up to a draught of 26 ft. are admitted into the harbour and it is proposed to increase the draught limit to 27 ft. The imports and exports through the port have risen from 59,561 tons in 1932-33 to 288,329 tons in 1934-35. All reasonable railway and shipping facilities have been provided at the port to meet traffic requirements. The Raipur-Vizianagram Railway, over 250 miles in length, was specially built to open up a large tract of country and to transport manganese ore from centres in the Central Provinces to Vizagapatam. The expenditure on the upkeep of the harbour in 1934-35 was Rs. 13,58,087.

Road-Rail Co-ordination in Indian States

The successful operation of road motor services by the Nizam's State Railway during the last few years has been accompanied by progressive extension from year to year. It is now understood that licences held by private agencies for the operation of bus services in the Hyderabad State and expiring within the next few months will not be renewed. The State Railway Road Motor Department will run a larger fleet of buses and lorries to connect the interior tracts of the State with various railheads.

The Mysore Government Administration Report for 1934-35 states that during the seven years from 1928, the State Railways have lost about Rs. 17 lakhs. Effective measures have now been taken to co-ordinate the different modes of transport, and the passing of the Mysore Road Traffic Regulation marks a definite landmark in the attempt to regularise and improve bus services.

Expert Inquiry into Railway Finances Demanded

During the general debate on the Railway Budget, Sir Leslie Hudson, leader of the European non-official group in the Legislative Assembly, stated that the Government had to decide whether the Indian railways were to be run on commercial principles, yielding a reasonable return on capital at charge, or as a State undertaking. He suggested that the railways were over-capitalised and he wanted Rs. 50 crores to be written back from the railway capital to the general accounts. The Railway Member promised to consider the proposition. Sir Leslie also viewed with anxiety the successive years of railway deficits and requested the Government to institute a thorough inquiry by experts; other members joined Sir Leslie Hudson in this demand. A reduction in the annual appropriations to the Depreciation Fund, the transfer of the strategic railways to the Military Department, the amalgamation of railways and a reduction in the rate of interest on railway capital, were some of the measures suggested by members to secure a balanced railway budget.

HOLLAND

Streamlined Locomotive

The Netherlands Railways have just concluded a series of trial runs with one of the Series-3,700, 4-6-0-type locomotives, recently streamlined. The streamlining consists of 2-mm. detachable steel plating enclosing practically the whole engine, and roofing in the tender also. Small smoke deflectors are fitted on both sides of the chimney orifice. The front part of the tender roofing slides back over the back part for coaling and watering. At a sustained speed of 100 km. (62 m.) p.h.—the engine working with a 20 per cent. cut off and 12-at. (176-lb.) boiler pressure—the drawbar pull, varied from 1,850 kg. to 2,000 kg. (1·82-1·97 tons), with an average of 1,940 kg. (1·91 tons); as compared with drawbar pulls of from 1,580 kg. to 1,660 kg. (1·55-1·63 tons) and an average of 1,615 kg. (1·59 tons), without the streamlining. An advantage of 325 kg. (0·32 ton) therefore resulted in favour of the streamlining, or almost exactly 20 per cent. (See illustration on page 657.)

Railway Museum Reopened

This museum has been reopened in new premises—as anticipated in an editorial note in THE RAILWAY GAZETTE of August 30 last—in the former State Railways office building at Utrecht; the old premises have been handed over to General Transport, a railway-associated road transport concern. The reopening of the museum took place on February 21. In the morning press representatives were shown round by the governing committee, and Mr. Heukelom in welcoming them paid a warm tribute to the late Mr. van Vloten, who, by presenting his own collection, initiated the museum: he also laid stress on its educational value. The official opening ceremony took place in the afternoon, when Mr. Heukelom addressed a distinguished company, including Dr. G. G. van Meulen, Secretary of the Public Works Department, Dr. E. C. W. van Dijk, General Manager of the Netherlands Railways, the curators of the Municipal and Postal Museums, representatives of the press, and railway officers. Dr. van Dijk replied and declared the new premises open, after which the guests made a tour of the exhibits.

Reconstruction of Utrecht Central Station

The long overdue reconstruction of this station is expected to be begun in September and be completed by the summer of 1937. The independent working of the group of bay lines, known as the Local station, is very inconvenient, and the necessity for the concentration of all traffic working is increasingly urgent. The booking office and other operating facilities also call for alteration, and so it has been decided to rearrange the whole of the lower floor layout of the main building, and throw out its front to the *Stationplein* or square in front of it. A new car-parking area 1,600 sq. yd. in extent is to be provided at the south end of the station by abolishing the publications office and some stables. The southern exit is to be retained though modernised, but the northern one will be replaced by the former Local station exit. Shops are to be built at both ends, and a running room and luggage office also.

JAPAN

Record New Year Holiday Traffic

New Year's Day is the most important of the year's holidays in Japan; this year the Japanese Government Railways report record bookings at all the principal stations. Osaka heads the list with 168,245 incoming and outgoing passengers, and with Y.92,992 (£5,425) receipts. The busiest stations in the capital, Tokyo and Ueno took Y.49,786 (£2,900) and Y.53,368 (£3,100) respectively. As the New Year holidays last five days there was heavy booking of long distance passengers on their annual visits to relatives, but the majority of journeys were short ones by pilgrims to the many shrines.

Unusual Level Crossing Accident

A serious accident occurred at the Okamoto level crossing on the Osaka-Kobe Hankyu electric railway after 9 p.m. on February 10. A train ran into a fire engine, 16 firemen being killed outright and 6 others and the train motorman seriously injured. The crossing is of class B, having crossing keepers on duty from 5 a.m. till 9 p.m., after which time a flashlight signal and automatic alarm bell protect it. The bells and lights were functioning correctly and visibility was good. In future such crossings are to be fitted with "no keeper on duty" signs, as a further protection.

In this connection it is of interest to note that it is an unwritten law that all traffic on the entire section of a line in which a fatal accident occurs must be suspended until after a preliminary investigation by the police. In this case the up line was not affected, and the railway officials

maintained a single line service for a short period after the accident. The local Government authorities, however, took very serious exception to this emergency measure. The other feature worth noting is that on the day following the accident the railway management sent a gift of 1,300 Yen (about £75) to the family of each of the dead firemen. In Japan this is in no way regarded as an admission of responsibility, it is a gesture of wealthy concerns, in cases like this, to give relief to the less well-off relatives of victims of accidents, and enable them to carry on while waiting for the inquiries and possible compensation.

Reduced Fares During Plum Blossom Time

Second and third class fares reduced 20 per cent. below standard, and available by specified trains to the plum orchard districts, will be in force from the middle of January till the middle of March. It is expected that similar concessions will be made during the cherry blossom time.

CHINA

Railway Amalgamation

The Taokow-Chinghua Railway in northern Honan, which crosses the Peiping-Hankow Railway at Sinsiang, is to be amalgamated with the latter. It was opened for traffic in 1904 and is a little over 100 miles in length.

Yellow River to be Bridged

The recently-completed southern section of the Tatung-Puchow Railway is to be connected with the Lung-Hai main line by a bridge spanning the Yellow River, to facilitate interchange of traffic. The bridge will be of the steel girder type and about 3,000 ft. in length and is expected to cost some $3,000,000. The existing ferry connection will continue until the completion of the bridge.

Rolling Stock Notes

After a tour of inspection of some of the railways by the newly appointed Minister of Railways, the Minister is reported to have come to the conclusion that the railways were hampered in their operations by inadequate supplies of rolling stock to meet present and future needs.

From the ss. *City of Hertford* there was landed at Woosung, on January 22, a locomotive of the Pacific type for the Nanking-Wuhu or Kiangnan Railway. This was the first Polish engine to come to China, and the manufacturers are Cegielski Limited. The engine with tender weighs 74 tons: it was worked under its own steam to Nanking over the Nanking-Shanghai Railway, and will be handed over to the Kiangnan line immediately the junction is put in to connect the two systems outside Nanking.

Six locomotives from the Vulcan Foundry arrived in the mv. *Belpamela* and were unloaded at the Nanking-Shanghai Railway wharf at Woosung on February 14. These engines are for the Canton-Hankow railway eventually, but for the time being will be put into service on the Nanking-Shanghai line. [These locomotives were described and illustrated in our issue of November 1 last.—Ed. *R.G.*]

Canton-Hankow Construction

Latest information concerning progress upon the Canton-Hankow construction shows that platelaying is now ahead of schedule and is 66 per cent. completed. It is, however, likely to be held up temporarily until the Lokow and one or two other bridges, and also certain tunnels, are finished. Over 100 km. of line are now laid from Hengchow southwards and 80 km. in the same direction from Chuchow. Railhead of the Kwangtung section—from Canton northwards—is near the Kwangtung-Hunan border.

Kiaochow-Tsinan Railway

Tsinan, the Provincial capital of Shantung, is the western terminus of the Kiaochow (Tsingtao)—Tsinan Railway, the eastern terminus being Tsingtao on the North China coast. Kiaochow was the name by which Tsingtao was known when it was in German occupation. It has now been decided to extend the line west of Tsinan to Tungchang (Liaocheng), a project that will assist in the development of the agricultural and mineral wealth of the province by providing connection with other railways via Tsinan and export facilities via Tsingtao. The receipts of this line for 1935 were approximately $15,500,000.

The extension is estimated to cost approximately $5,000,000, and will actually terminate beyond Tungchang at Liuchow on the border of the provinces of Hopei and Shantung. The estimate for the cost of construction takes into account the employment of flood refugees and soldiers, which will enable a reduced cost of labour whilst assisting in the feeding of victims of the recent flood disasters.

UNITED STATES

Labour Demands

The railway labour organisations are pressing for passage of a Six-Hour-Day Bill, a Full Crew Bill (increasing the number of trainmen per train) and other legislative proposals that would greatly increase railway expenses. The unions have recently added to their list of bills one designed to prevent the dismissal of employees in economy schemes. This is to replace similar but less severe provision in the Emergency Transportation Act of 1933 which expires in June. The managements and the union chiefs are discussing the question of the provision to be made for employees displaced in rationalisation schemes, and this Bill is by way of a threat to the managements in the event of their failure to agree to the concessions the unions demand.

Railway Equipment Buying Increases

The railways are actively in the market for new materials and rolling stock. In the first two months of 1936 50 steam locomotives and 10 diesel-electrics were ordered, as compared with only 83 engines of all kinds ordered in the whole of 1935. Over 8,000 freight cars and 37 passenger cars were ordered during January and February and inquiries are outstanding for 50 additional passenger cars. Rails totalling 298,300 tons have already been ordered this year, as compared with less than twice that tonnage throughout 1935. Several Eastern railways will probably have to buy passenger coaches if the reduced fares ordered by the Interstate Commerce Commission come into force. £4,000 each is almost the lowest price for passenger coaches.

BRAZIL

Railway Engineering and Legislative Congress

In the course of this recent congress which was held at Campinas—as briefly mentioned in an earlier issue of The Railway Gazette—one of the many theses on railway and transportation subjects presented was entitled "Modern Locomotives, with Emphasis on the Beyer-Garratt Articulated Type," by Dr. Adolpho José Moreira, of the Federal Inspectorate of Railways.

After allusion to recent locomotive developments, such as the great increase in boiler power demanded by higher freight train speeds—amounting on the average to as much as 42 per cent. since 1923—in the U.S.A., turbine and diesel-electric locomotives were briefly dealt with in this thesis: there were, however, many difficulties that, in the opinion of the author, restricted their general adoption.

His main object was to discuss articulated types of steam locomotive, and after showing how designers turned their attention to these types, once the modern locomotive of standard pattern had reached the maximum limit of power consonant with strength of track and bridges, he cited various designs, and made special reference to the first Garratt constructed by Beyer Peacock & Co. Ltd., at Gorton in 1909.

The Garratt Locomotive in Brazil

The main features and advantages of the Beyer-Garratt type were dealt with at length by Dr. Moreira, allusion being made to tests and experimental runs carried out by railways in other countries. In Brazil, he said, four systems used these locomotives: the São Paulo, the Great Western and the Leopoldina Railways and the Viação Ferrea do Rio Grande do Sul. Letters were read at the congress from the administrations of the Great Western and the Leopoldina indicating that

their Garratts were giving entire satisfaction; on the latter system in particular they have proved invaluable during the months of heavy coffee traffic, being concentrated on the Itapemirim-Victoria section—where 3 per cent. grades and sharp curves abound—and bringing about a substantial reduction in train-mileage. The São Paulo Railway utilises its Garratts for the haulage of heavy passenger and freight trains mainly between São Paulo and Jundiahy, and the V. Ferrea do R. Grande do Sul, which has 10 in all, employs most of them on the day and night passenger services between Santa Maria and Porto Alegre.

Dr. Antonio Corrêa Pereira da Silva, who reported on Dr. Moreira's thesis, recommended the approval by the congress of the following conclusions:—

(*a*) That public authorities, in conjunction with the Federal Inspectorate o Railways, show preference for the articulated locomotive of the Garratt type, in all cases where the local conditions cannot be met satisfactorily by locomotives of other types possessing the same tractive force.

(*b*) That, with a view to bringing about uniformity in all rolling-stock, attention be paid to standardisation of brakes, buffing-gear, &c., on the Garratt locomotives.

SPAIN-PORTUGAL

New Hispano-Portuguese Connection

There is at present no direct rail communication between Lisbon and Southern Spain, the shortest existing route from the Portuguese capital to Algeciras, Cadiz, Malaga and the other southern Spanish ports, and to the Seville area, being via Abrantes, Badajos and Merida, nearly 200 km. north of Seville and over 300 km. north of most of those ports. Considerable importance therefore attaches to a new international connection which is now being undertaken between Zafra—on the Merida-Seville line of the M.Z.A. system, and also the junction for the Zafra-Huelva company's line—and Reguengos, the terminus of a branch line taking off the Barreiro (Lisbon)—Casa Branca—Villa Vicosa section of the Portuguese State system at Evora.

The gap at present existing across the frontier between Zafra and Reguengos is about 100 km. or say 60 miles, and when the construction of this length of line has been completed, there will be a comparatively direct railway connection between Barreiro—on the south bank of the Tagus opposite Lisbon—and Southern Spain, a saving in distance of 100 or more kilometres being effected. As it is also intended that the Tagus shall be bridged in the not far distant future, Lisbon itself will eventually be linked directly by rail with Zafra and all points east and south of that junction.

Construction Programme

Of the 100 km. of line to be constructed from Zafra, the first section to Jerez de los Caballeros is to be completed this year, and a further section to Villanueva del Fresno—a point only 8 miles from the frontier, and 35 km. from Reguengos—in 1937. This remaining 35 km. length includes, however, the crossing of the River Guadiana, and there is at present no certainty as to when construction upon it will be undertaken.

Through and Local Traffic

When this line and the Tagus bridge are completed there will be a new overland route from Lisbon via Seville to Algeciras for North Africa, which is expected to prove valuable to certain industries and also as a passenger-carrying line, and to share in the increasing prosperity of French Morocco, between which territory and Lisbon there is already a steadily developing goods and passenger traffic. Some of the passengers who disembark from Transatlantic steamers at Lisbon travel overland to Algeciras in spite of the great inconvenience of the existing routes, and others proceed thither in coasting vessels. But a good railway connection would stimulate this traffic by affording a much quicker and more comfortable service.

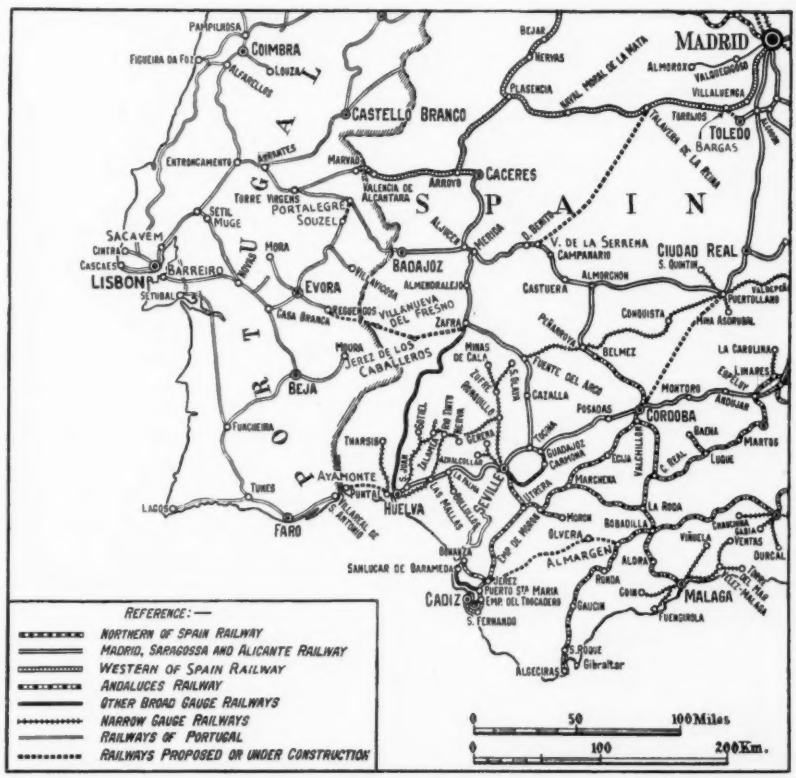
Direct Connection with Cordoba

The new line when completed will also provide better connection between Lisbon and Cordoba and the main line of the M.Z.A. thence towards Madrid, and also the whole of the Andaluces Railway system via Belmez, the terminal point of that system to the north-west of Cordoba.

There should also be an appreciable local traffic from the outset, for the Spanish section of the line traverses a rich agricultural and cattle-breeding district, and there is also considerable mineral wealth available for development when economic conditions in other countries, notably Germany, improve: there is a bright potential market in that country for these minerals, which will greatly benefit the new railway.

The Concession for Construction

The Zafra to Portgual Railway Company received a concession for building a line from Zafra to Villanueva del Fresno under certain decrees, the last being dated April 4, 1931, based on the Railway Act of 1927. Although this length of line is entirely upon Spanish soil, its international importance was fully recognised, and at a conference held in Lisbon in May, 1928, it was agreed that the trans-frontier connection with Reguengos ought to be completed as early as possible, and the most suitable route for it selected by a mixed commission. According to the *Gazeta dos Caminhos de Ferro*, to which we are indebted for some of the foregoing particulars, progress of the work on the Zafra-Villanueva del Fresno section is in a forward condition according to programme.



Sketch map showing the Zafra-Reguengos and other connections which together will complete a new through route between Lisbon and Southern Spain

WELDED PLATE GIRDER BRIDGES FOR RAILWAYS

Dipl.-Ing. O. BONDY, M.I.Struct.E.

IN an earlier article (THE RAILWAY GAZETTE, September 27, 1935, page 492) the author dealt with progress in the welding of large railway bridges and gave particulars of new rolled sections and methods of inspecting welds in heavy plate girders. Following the publication of that article, many requests were received from readers for further information, some of which is embodied in the present article and supplemented by examples of recent practice in the design and construction of welded joints. It must, however, be emphasised that fresh developments are continually emerging, and even the latest practice offers no final solution to the various problems encountered.

Large welded bridges, which have become increasingly common on railways during recent years, impose new problems of design, workshop practice, and particularly welding practice. The local development of intense heat is an essential and distinctive feature of welding, and one which necessarily involves thermal stresses. These stresses must not be ignored, but experience in the construction of welded structures has now reached such a level that their effects can be controlled with reasonable ease and without undue expense.

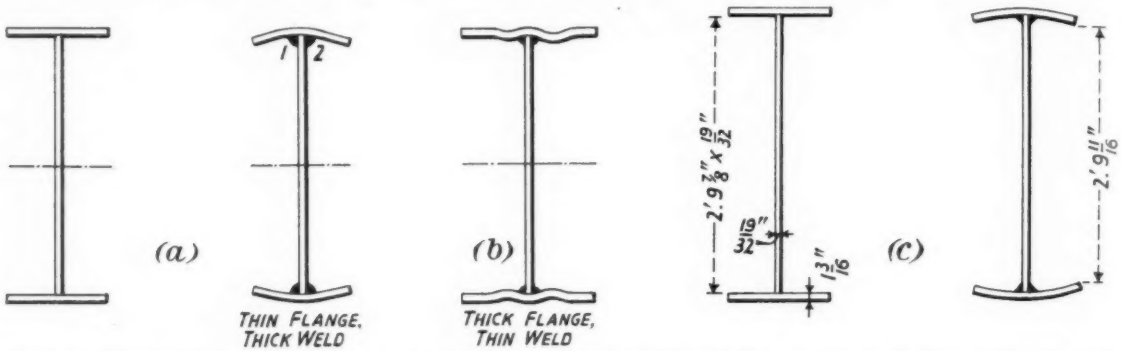


Fig. 1—Deformation by shrinkage in welded plate girders, (a) with thin flanges and thick fillet welds; (b) with thick flanges and thin fillet welds; and (c) plate girder for the first welded bridge of the German State Railway, built at Münster in 1930

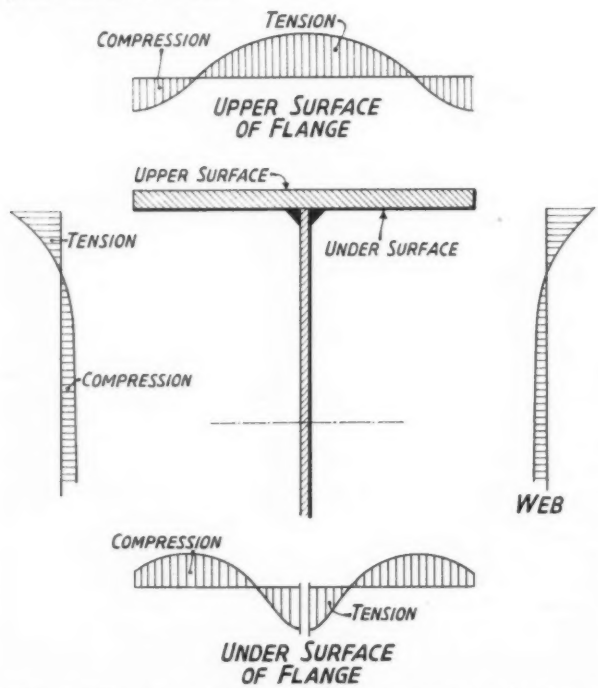


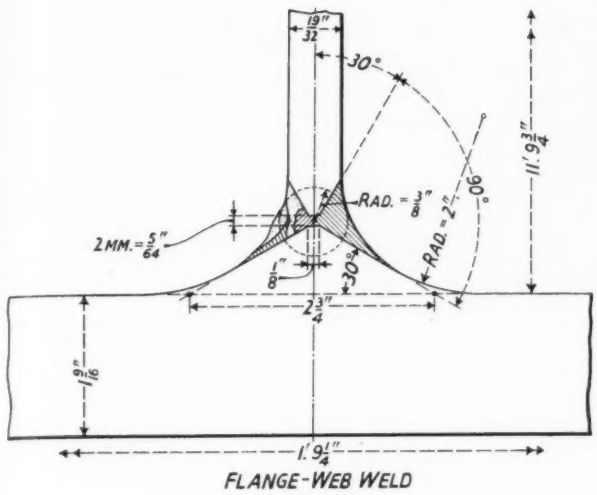
Fig. 2—Nature and distribution of stresses in the flange and web surfaces of a welded plate girder

Thermal Distortion

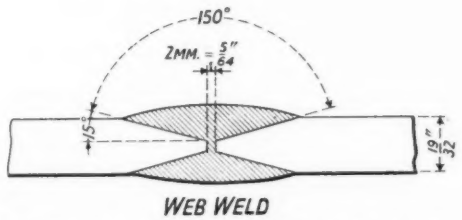
The effects of shrinkage in welded plate girders are illustrated by the accompanying drawings, Fig. 1. With very thin flanges and a thick weld, the contraction of the welds *1, 2,* Fig. 1a, pulls the top flange downwards. Similarly, the bottom flange is drawn upwards, the resultant deformation of the girder being as shown (exaggerated) in the drawing. With a relatively thick flange and thin weld, however, the contraction of the welds affects only the central portion of the flanges, leaving the edges in their original position. It depends upon the relative thickness of the web and flange whether the contraction results in a permanent deformation, as shown exaggerated in Fig. 1b, or whether there are only internal stresses in the flanges. The latter is usually the case in plate girders with relatively thick flanges, as used today, but the possibility of deformation must be taken into account. In this connection, it is instructive to note that the first welded railway bridge in Germany, built at Münster in 1930, suffered deformation by shrinkage as shown in Fig. 1c. Means of eliminating such thermal effects are explained later.

The magnitude of thermal stresses and the amount of resultant distortion can be predicted approximately from the results of trials and practical experience, and the welding operations in the workshops can be arranged accordingly. For example, the thickness of the distance plates used in assembling the parts of a plate girder must be suitably increased, and a tapered or wedge-shaped gap is used to equalise contraction when making longitudinal welded joints. Stress measurements* show definitely

* H. Bühler, "Geschweisste Träger"; Dortmunder Union, No. 3, October, 1935.



FLANGE-WEB WELD



WEB WELD

Fig. 3—Welded joints in plate girders for the Rügendamm bridge. Span 52 metres (170 ft. 7 in.), depth of web 3,600 mm. (11 ft. 9¾ in.)

that, after the welding of a plate girder, there are tensile stresses in the upper and lower sides of the flange near the web, but compression stresses near the edges, as shown diagrammatically in Fig. 2. It is essential to obtain a clear understanding of these and similar actions in order that the workshop operations may be adapted to them. In all probability it will soon be possible to take contraction stresses into account in the static design of welded structures by allowing them to act at such points and to such an extent that they constitute a natural initial loading reducing the net stresses produced by the applied load. The author published proposals some years ago* for the application of this method to the case of a two-pin frame.

Avoidance of Internal Stress

The plate girders of the Rügendamm bridge, with 52 m. (170 ft. 7 in.) span, are the largest yet built by welding. In this case, steps were taken both in design and in the execution of the welds to avoid distortion due to thermal stresses. Thus, the flanges are of special section, with a boss of approximately triangular form, as shown in Fig. 3,† and a number of constructional precautions were observed to ensure satisfactory transmission of stress and compensate for the effects of the heating inseparable from welding.

The detail of the weld between the 40-mm. (1 9/16-in.) flange and the 15-mm. (19/32-in.) web is shown by Fig. 3. Corresponding to the inscribed circle of 9 mm. (nearly ⅜ in.) radius, the designed thickness of this butt weld is 18 mm. (nearly ¾ in.), and it is evident from the form of the triangular boss that the effect of shrinkage on the flange can only be very small. Also, the weld is built up in eight layers (four each side) in order to ensure thorough penetration and reduce shrinkage effects. From experience and the results of measurements it is evident that the shrinkage stresses in plate girders welded by this method are never greater than the internal stresses in rolled girders, which are usually ignored. It is, however, common knowledge, confirmed by trial, that considerable distortion may result from cutting a rolled girder through the centre of the web. This can be due only to internal stresses established during the rolling operations.

A rotary jig, used to enable the welds in the plate girders for the Rügendamm bridge to be made in a horizontal position, is shown diagrammatically in Fig. 4. Similar devices are used extensively for other large welding jobs, especially in the United States of America and in Sweden. Work is expedited and better welds are secured. In the case of the Rügendamm girders, the jig discs were turned as required by means of pulley blocks, and the finished 52-metre (170-ft. 7-in.) girders, each weighing about 42 tons, were loaded on the railway adjoining the welding shop.

Type and Size of Electrodes

The choice of electrodes is an important matter in the welding of such large structures. The first layer of weld metal, in the root of the weld between the web and flange in Fig. 3, was deposited by 3-mm. (⅛-in.) electrodes. The first weld was thus kept as small as possible, ensuring good penetration and minimum shrinkage. The following layers were welded with electrodes up to 5 mm., or at most 6 mm. (3/16 to ¼ in.) diameter. The rate of welding can be increased and costs reduced by the use of thicker electrodes and heavier currents, but the practice rightly followed in the welding of the large German bridge was

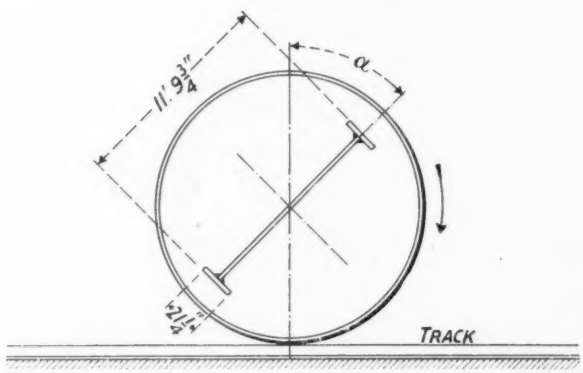


Fig. 4—Rotary jig used in welding plate girders for the Rügendamm bridge

to use small electrodes and deposit the thick welds in a number of layers. Each layer is then annealed by heat from the next one deposited, thus relieving internal stresses.

Coated electrodes were used for the butt welds in the web, Fig. 3, but bare electrodes were used for all the other joints. During recent years most of the welding in Germany has been done with bare electrodes, but there is an increasing tendency to use thickly coated electrodes, at least for high quality work. The wide angle of the double-vee is a striking feature of the web butt joint,

* O. Bondy, *Zeitschrift des Vereines deutscher Ingenieure*, November 15, 1930.

† A. Seeger, *Zeitschrift des Vereines deutscher Ingenieure*, September 28, 1935.

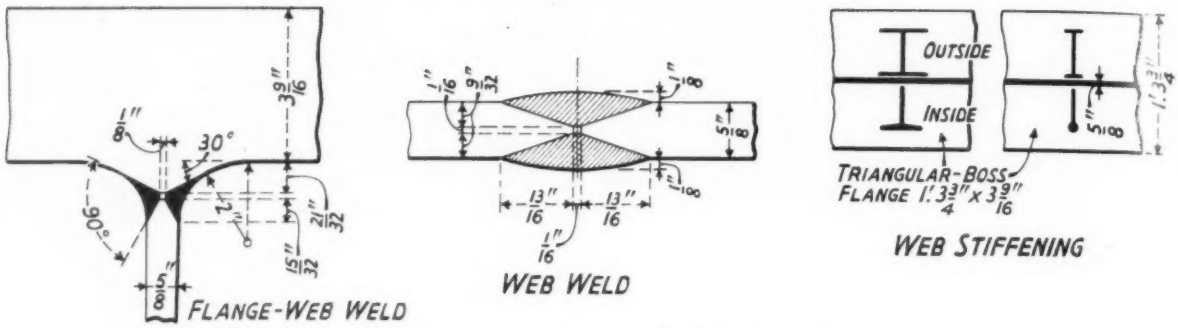


Fig. 5—Welded plate girder details for a railway bridge of 32·9 metres (107 ft. 11 in.) span. (J. Gollnow & Sohn, Stettin)

Fig. 3; this angle, amounting to 150 deg., much exceeds the usual value, but it was chosen on the basis of the results of prolonged endurance tests on butt welds.

Latest Developments

Another welded railway bridge of more recent construction is that at Stettin, with a smaller span (32·9 m., or 107 ft. 11 in.), but with a more unusual ratio between flange and web thicknesses than in the Rügendamm bridge. Details of the flange and web welds are shown in Fig. 5, together with the method of stiffening the web. The same general methods of construction and welding were used as for the Rügendamm girders, including the use of special rolling jigs for horizontal welding. The handling of a 90-mm. (3⅝-in.) flange in a single piece 33 m. (108 ft. 3 in.) in length represents a remarkable achievement.* By using different reinforcing sections and thus staggering the welds in the stiffening of the web, the coincidence of four fillet welds within a narrow zone is avoided.

The recently published preliminary regulations for the welding of plate girder bridges on the German State Railway relate mainly to details concerning designers. There is, however, much in these regulations of importance to welding engineers and workshop operators. The rules are based on the results of 4-year fatigue tests of welded connections, including some of large dimensions, built into the so-called vibrator (?) bridge (*Schwingbrücke*). Also, as there are now more than 200 welded railway underbridges in service on the German railways, it may be taken that the new rules embody the latest results of extensive practical experience.

There is at present under construction for the German State Railway a yet larger welded bridge with continuous plate girders 62 m. (203 ft. 5 in.) in length, extending over three spans, and a web depth of 4 m. (13 ft. 1½ in.). The decision to build so large a bridge by welding is a clear indication of the satisfactory results already obtained by this method of construction. The danger of distortion or excessive stress resulting from contraction has been overcome by appropriate design, arrangement, and execution of joints. No special annealing or other heat-treatment is necessary, and there remain in the completed structure only small internal stresses, the unimportance of which can be confirmed at any time by actual measurement and by X-ray inspection of the joints.

* H. Wolf, *Die Bautechnik*, May 10, 1935.

Transfer of the Iraq Railways to the Iraq Government

THE final details of the agreement whereby the Iraq Railways become the property of the Iraq Government are now being completed with a view to the official date of transfer being taken, as April 1, 1936. Generally speaking, the arrangement is that Iraq buys out the British Government's interests in the undertaking for a cash payment of £400,000. It is pertinent at this stage to examine what the Iraqi Government acquires and the British Government relinquishes. The total book value of the railway's fixed assets on date of transfer should be approximately £2,500,000, of which sum assets to the value of only £343,875 were provided from Iraqi Government loans, the cost of the remainder having been in the main at the expense of the British Government, aided during the past thirteen years by funds made available from the surplus of revenue over expenditure. In addition there are being handed over £114,000-worth of stores and more than £300,000 in cash. An analysis of these figures goes to show that for a payment of £400,000 now, the Iraqi Government will recover the assets represented by its loans, plus stores and cash valued at over £414,000 with further assets valued at approximately £2,150,000 thrown in. On the other hand the British Government will receive a comparatively trivial sum in cash for relinquishing an investment in worth today, on paper, more than six times that amount.

At first glance it might appear that Britain has made too generous a gesture to its latest ally, who comes into possession of a ready-made and well-equipped railway of 930 track miles at the low cost of £800 a mile. Also as a matter of practical politics the cash value to the British Government of this relic of the war proves to be only the amount which the Iraqi Government is prepared to pay for it. The British Exchequer, however, is to be commended upon its realism in preferring a handy little cash windfall to an otherwise unrealisable paper asset.

For the moment it is not advisable to go into further details of this transaction, as we are officially informed that the terms of the agreement have not yet been finally settled. It may, however, be recalled that the Mesopotamian Railways, to give the system its first name, were built originally as a war measure, consequently the exigencies of time and circumstance greatly outweighed the claims of cost and quality. The difficulties with which the Army was faced are hard to realise at this late date. Materials and equipment were scarce and shipping facilities restricted. Rails, steelwork, machinery, sleepers, locomotives and rolling stock had to be gathered together from whatever quarter they were available. India and England were the main sources of supply, and what they had to spare was not always of the best, but the railways have served their purpose admirably.

THE INFLUENCE OF SPEED ON LOCOMOTIVE HAULAGE CAPACITY AND FUEL CONSUMPTION

Discussion on methods of measurement

UNDER the above title Mr. T. Grime contributed an article which appeared on pages 303 and 304 of the issue of THE RAILWAY GAZETTE dated August 23, 1935. We have since received from the General Electric Company of America a communication dealing with the subject matter of the article and the contentions put forward by the author. We submitted this statement to Mr. Grime who has replied to it in an equally interesting fashion.

Both of these communications, upon which our own comments appear on page 646, seem to us to be of sufficient interest to reproduce in full and we accordingly reprint them herewith. That from the General Electric Company reads as follows:—

Mr. Grime has indicated that there still remains considerable indecision respecting locomotive and train resistance factors as affecting train operation.

A number of years ago Mr. W. J. Davis, an engineer associated with the General Electric Company, made a comprehensive study of this subject, based upon all of the then available knowledge, obtained from tests, and compiled formulæ, curves, &c., applying to practically every phase of railway operation, and to steam locomotives by treating separately certain frictional losses affecting only the reciprocating steam engine.

It is customary, in the case of problems similar to the one discussed by Mr. Grime, to establish the potential economic indicated horsepower of the steam engine by the combustion or evaporative method, which in effect is normally limited by boiler capacity, and then reduce such indicated horsepower to speed and tractive effort units in the manner shown by the form reproduced herewith, which is used by the American Railway Engineering Association. The translation factors take cognisance of the above mentioned frictional losses of the reciprocating parts, so that the resultant is expressed in output at the rims of the driving wheels. No deduction has as yet been made for journal friction, skin friction, wind resistance, &c., which can now readily be ascertained by use of the Davis formulæ. For this purpose, it might be well to treat separately the locomotive and tender.

The establishment of a speed-tractive effort curve should first be effected by use of the factors mentioned in the preceding paragraph. The normal assumption for such a curve might be made upon the basis of consuming 120 lb. of coal per sq. ft. of grate area, bearing in mind that the profile conditions, maximum speed limitations, stops, &c., will in the final analysis produce an average figure of 80-90 lb. per sq. ft. of grate area for the contemplated trip, which average is in line with the author's viewpoint as to economic performance. It must be recalled, however, that at points where maximum output is required, coinciding with the four desired speed on level track, the available output will be found on the curve based upon the higher coal consumption factor.

Presuming for the present that the desirable tractive effort limit, as shown by Mr. Grime, corresponds to the established curve, also that the specified speeds represent the point of balance on level, tangent track, that it is desired to obtain, then the prime factors remain as follow:—

Balanced speed (m.p.h.)	60·0	65·4	72·0	80·0
Tractive eff at wheels (lb.)	7,120	6,540	5,940	5,350

It is now desired to obtain the trailing train weight and consequently the number of cars that can be handled under the four specified conditions. Thus, resorting to the Davis formulæ, the results are obtained in the manner hereinafter shown. Before proceeding with the calculations, however, it might be well to establish the nomenclature applicable to the symbols and reduce the steam engine weights, as given, to 2,000-lb. tons. Thus, we have:—

Locomotive classification	4-6-0
,, weight (82 English tons)	92·0 tons.
Weight on drivers (61 English tons)	68·5 ,,
,, of tender (45 English tons)	50·5 ,,
,, of cars (approximate)	40·0 ,,

Davis' symbols:

R = Tractive resistance in lb.
A = Area in sq. ft. cross section (assumed 110 sq. ft.).
V = Speed in m.p.h.
n = Number of axles (locomotive, tender or car).
w = Weight per axle in tons.
wn = Average weight of locomotive, tender or car.

The application of the Davis formulæ, to the specific case in question, follows:—

69·0 m.p.h.

Locomotive ... $R = 1{\cdot}3 + \frac{29}{w} + 0{\cdot}03V + \frac{0{\cdot}0024AV^2}{wn} = 15{\cdot}08$ lb./ton

Tender ... ... $R = 1{\cdot}3 + \frac{29}{w} + 0{\cdot}045V + \frac{0{\cdot}044V^2}{wn} = 8{\cdot}85$ lb./ton

Locomotive ..	15·08 × 92·0	= 1,385 lb.
Tender	8·85 × 50·5	= 447 ,,
	Total	= 1,832 lb.

7,120 − 1,832 = 5,288 lb. for cars

Cars ... ... $R = 1{\cdot}3 + \frac{29}{w} + 0{\cdot}03V + \frac{0{\cdot}041V^2}{wn} = 9{\cdot}7$ lb./ton

$\frac{5{,}288}{9{\cdot}7} = \frac{543 \text{ tons}}{40} = 13$ cars +

65·4 m.p.h.

Locomotive ... $R = 1{\cdot}3 + \frac{29}{w} + 0{\cdot}03V + \frac{0{\cdot}0024AV^2}{wn} = 17{\cdot}14$ lb./ton

Tender ... ... $R = 1{\cdot}3 + \frac{29}{w} + 0{\cdot}045V + \frac{0{\cdot}044V^2}{wn} = 9{\cdot}71$ lb./ton

Locomotive ...	17·14 × 92	= 1,575 lb.
Tender	9·71 × 50·5	= 490 ,,
	Total	= 2,065 lb.

6,540—2,065 = 4,475 lb. for cars.

Cars ... ... $R = 1{\cdot}3 + \frac{29}{w} + 0{\cdot}03V + \frac{0{\cdot}041V^2}{wn} = 10{\cdot}57$ lb./ton

$\frac{4{,}475}{10{\cdot}57} = \frac{423 \text{ tons}}{40} = 10$ Cars +

72·0 m.p.h.

Locomotive ... $R = 1{\cdot}3 + \frac{29}{w} + 0{\cdot}03V + \frac{0{\cdot}0024AV^2}{wn} = 19{\cdot}94$ lb./ton

Tender ... ... $R = 1{\cdot}3 + \frac{29}{w} + {\cdot}045V + \frac{0{\cdot}044V^2}{wn} = 10{\cdot}81$ lb./ton

Locomotive ...	19·94 × 92	= 1,790 lb.
Tender	10·81 × 50·5	= 548 ,,
	Total	= 2,338 lb.

5,940 − 2,338 = 3,602 lb. for cars

Cars ... ... $R = 1{\cdot}3 + \frac{29}{w} + 0{\cdot}03V + \frac{0{\cdot}041V^2}{wn} = 11{\cdot}69$ lb./ton

$\frac{3{,}602}{11{\cdot}69} = \frac{309 \text{ tons}}{40} = 7$ cars +

80·0 m.p.h.

Locomotive ... $R = 1{\cdot}3 + \frac{29}{w} + 0{\cdot}03V + \frac{0{\cdot}0024AV^2}{wn} = 23{\cdot}63$ lb./ton

Tender ... $R = 1{\cdot}3 + \frac{29}{w} + 0{\cdot}045V + \frac{0{\cdot}044V^2}{wn} = 12{\cdot}21$ lb./ton

Locomotive ... $23{\cdot}63 \times 92 = 2{,}175$ lb.
Tender ... ... $12{\cdot}21 \times 50{\cdot}5 = 619$,,
Total = 2,794 ,,

5,350—2,794 = 2,556 lb. for cars.

Cars ... ... $R = 1{\cdot}3 + \frac{29}{w} + 0{\cdot}03V + \frac{0{\cdot}041V^2}{wn} = 14{\cdot}34$ lb./ton

$\frac{2{,}556}{14{\cdot}34} = \frac{179 \text{ tons}}{40} = 4$ cars +

The following table comprises the conclusions reached by Mr. Grime and those found by the use of the Davis formulæ:—

Balancing speed	Grime		Davis	
	Tons*	Cars	Tons*	Cars
60·0 m.p.h.	444	11+	543	13+
65·4 ,, ...	315	7+	423	10+
72·0 ,, ...	200	5	309	7+
80·0 ,, ...	95	2+	179	4+

* 2,000-lb./tons.

At the time of the inception of the Davis formulæ, the extensive use of streamlining, as applied to railway rolling stock, had not come into vogue. Recent developments along these lines, especially with respect to the diesel-driven, articulated trains, indicate that the air resistance constant shown as $0{\cdot}0024AV^2$ for the locomotive, can be reduced about 50 per cent. when effective streamlining is applied, also that some reduction can be made in the passenger car constant of $0{\cdot}041V^2$, which incidentally applies to vestibuled trains, when window and other projections are reduced, in so far as possible, and the tail end of the last car is shaped so as to minimise vacuum effects. More or less definite figures, now available, apply to specific cases. Generally speaking, the variations in the constants used will depend entirely on the effectiveness of what might be termed the details of streamlining.

The Author's Reply

The foregoing communication was submitted to Mr. Grime, who replied as follows:—

I have read with great interest the remarks on train resistance forwarded by the General Electric Company, and as this bears directly on my article published in THE RAILWAY GAZETTE of August 23, I take the opportunity of submitting the following comments.

Considering first the method of determining locomotive capacity, this is based on a formula developed personally from data given in Lawford Fry's book, "A Study of the Locomotive Boiler," supplemented by data obtained in the Petiet trials on the Northern Railway of France, and checked, as far as possible, against modern published trials on English railways. Whilst calculations of this nature cannot be accepted as absolutely final, especially in view of the many variables encountered when fuel is burned at very high rates of combustion, the writer considers the method adopted to be better based, and more accurate for *general* application (particularly for locomotives of proportions encountered in this country), than is the method developed by F. J. Cole and given at length in "The Locomotive Hand Book" published by the American Locomotive Company.

Considering the engine output developed at a firing rate of 120 lb. per sq. ft. of grate per hr., Cole's method applied to a locomotive of the proportions taken would give a rated evaporation of 20,730 lb. of steam per hr., or with Cole's figure of 20·8 lb. of steam per h.p. hr., a capacity of 990 h.p. at this firing rate.

By the writer's method, the evaporation at 120 lb. per sq. ft. of grate would be 23,700 lb. or (at 18 lb. of steam per h.p. hr.) 1,312 h.p. which appears to be much nearer to the h.p. capacity of a modern 4-6-0 British express passenger locomotive when fired at this rate.

It must not be thought that the writer wishes to depreciate the value of the work done by Cole, as, within its limits and for the types of locomotive covered, Cole's method forms a very useful basis of comparison. For general application, particularly to locomotives with narrow fireboxes as usual in this country, the volume of the firebox in relation to the grate must be considered, and for this reason the writer's view is that combustion per unit of firebox volume, and not grate area, forms a much better basis of comparison.

The writer must confess that he had not previously encountered the Davis formula for computation of locomotive and train resistance. As this is apparently accepted as a working basis by the General Electric Company of America, it must be treated with respect. The article, however, was written from the standpoint of English conditions, and the writer gave very careful consideration to all the data he possessed before finally adopting the formula proposed by Mr. Dendy Marshall for train resistance, and taking a somewhat original step in determining the resistance of the locomotive and tender. As could be seen from the article, the assumed locomotive would keep time easily enough with those extra two coaches proposed by Mr. Davis, but the writer would expect a higher fuel consumption in consequence.

In view of the wide variation in the above results, all forward by the General Electric Company, it would be very interesting to compare the total engine and tender resistance from well-known formulæ at speeds of 60-80 m.p.h. These are as follow:—

Speed	60 m.p.h.	80 m.p.h.
Resistance Davis formula	1,832	2,794
,, Writer's method	2,351	3,785
,, Baldwin loco. Works ($4{\cdot}3 + 0{\cdot}003\ V^2$)	2,160	3,360
,, American Loco. Co. (see tables in "The Locomotive Handbook")	3,060	3,915
,, Henschel	2,795	3,745
,, Dendy Marshall	3,550	5,000
,, Lawford Fry	4,100	5,800

In view of the wide variation in the above results, all (with the exception of the writer's) being obtained from formulæ having the backing of well-known authorities, the writer must be pardoned if he feels that there is still a general uncertainty regarding locomotive resistance at high speeds.

The writer quite agrees with the editorial comment on his article that an attempt to deal with all the functions involved in accurately determining engine resistance at high speeds in words would be at least as puzzling as an income tax return, and is also inclined to the opinion that a *steam* locomotive at any rate is of too human a character always obligingly to fulfil the predictions of the differential calculus merchant, however intricate the higher mathematics employed may be.

With regard to the train resistance, the dynamometer car places us on firmer ground, although it is unfortunate that as far as the writer is aware no authoritative data have been published by English Railways which enable an accurate estimate to be made of train resistance at very high speeds. At normal express speeds the following data of *mean* resistances on long runs is of interest. They have

been derived from data published by Sir Henry Fowler and obtained on the L.M.S.R., and also from published results of tests carried out on the L.N.E.R. On the L.M.S.R. three runs from Euston to Carlisle gave a mean speed of 52·9 m.p.h. and a mean resistance of 11·5 lb. per ton, and three runs in the reverse direction a mean speed of 49·6 m.p.h. and a mean resistance of 12·1 lb. per ton, the average for both directions being 51·25 m.p.h. and 11·8 lb. per ton. Four trips from Crewe to Euston gave a mean speed of 53·9 m.p.h., and 11·04 lb. per ton, and three trips in the reverse direction, a mean speed of 53·9 m.p.h. and 10·68 lb. per ton, or a mean resistance of 10·86 lb. per ton. Six trips from Crewe to Carlisle gave a mean speed of 51 m.p.h. and 12·02 lb. per ton, and six trips in the reverse direction 48·7 m.p.h. and 11·59 lb. per ton, the means for all trips being 49·85 m.p.h. and 11·8 lb. per ton.

FORM FOR CALCULATING THE TRACTIVE EFFORT AND HORSEPOWER OUTPUT OF TYPICAL STEAM LOCOMOTIVES.

SUPERHEATED STEAM

Item

1. Type (wheel arrangement) .....
2. Weight on drivers (tons) .....
3. Weight of engine .....
4. Weight of tender .....
5. Total weight .....
6. Ratio item (2)/Item (3) .....
7. *Cylinder horsepower per ton on drivers .....
8. *Boiler horse-power per ton on drivers.....
9. Potential h.p. capacity ; Item (7) or Item (8) × Item (2).....
10. $V_1 = 0·395 \times$ Item (7) or Item (8) .....

Speed		Driver tractive effort				Driver horse-power	Tractive resistance	
V	M.P.H.	Per ton on driver		Total			Per ton	Total
		A	B	A	B	A	†	
(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)	(*g*)	(*h*)	(*k*)
0	0	500	600					
1·00 × V_1		480	580					
1·25 ,,		463	522					
1·50 ,,		438	471					
1·75 ,,		410	428					
2·00 ,,		384	390					
2·25 ,,		357						
2·50 ,,		328						
2·75 ,,		302						
3·00 ,,		280						
3·50 ,,		243						
4·00 ,,		213						
4·50 ,,		188						
5·00 ,,		168						
6·00 ,,		138						
7·00 ,,		115						

A—without booster. B—with booster.

Weight on booster axle is not considered as weight on drivers.

* Obtain Item 6 or 7 by consulting chart.

† Use Davis Tractive Resistance Formulæ.

Col. (*b*) = Col. (*a*) × Item (10). Col. (*e*) = Col. (*c*) × Item (2).

Col. (*f*) = Col. (*d*) × Item (2). Col. (*g*) = Col. (*b*) × Col. (*e*)/375.

Col. (*k*) = Col. (*h*) × Item (5) + 10 per cent.

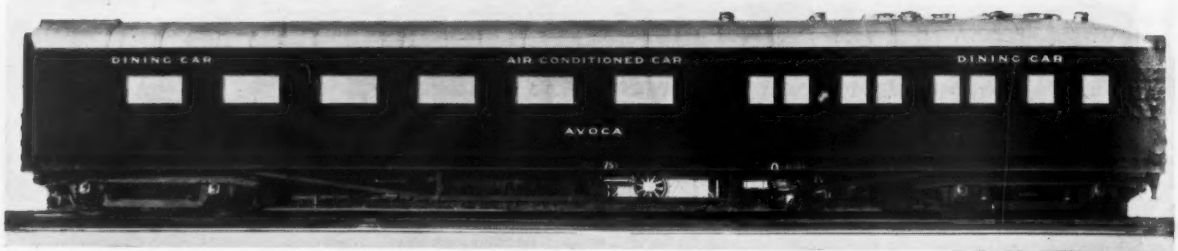
On the L.N.E.R., two trips from Doncaster to King's Cross gave results of 52·8 m.p.h. and 11·38 lb. per ton, and 54·7 m.p.h. and 9·9 lb. per ton, a mean of 53·75 m.p.h. and 10·64 lb. per ton. Converted to English units, the Davis curves for a passenger car of 40 U.S. tons (35·7 English tons) gives a resistance of 9·2 and 10·08 lb. per ton at 50-55 m.p.h. respectively, which taken generally seem somewhat on the low side, although remarkably near to the L.N.E.R. results. Results of train resistances taken from dynometer tests, even when determined from the means of runs in opposite directions on the same track as in the case of the L.M.S.R. results quoted, are invariably somewhat higher than the actual resistance at balanced speed on level tangent track on account of acceleration forces, but from a practical standpoint, the error involved is not very great on runs of the length considered, and any discrepancy is on the safe side.

In conclusion the writer wishes to state that he much appreciates the interest aroused by his article in such an authoritative quarter.

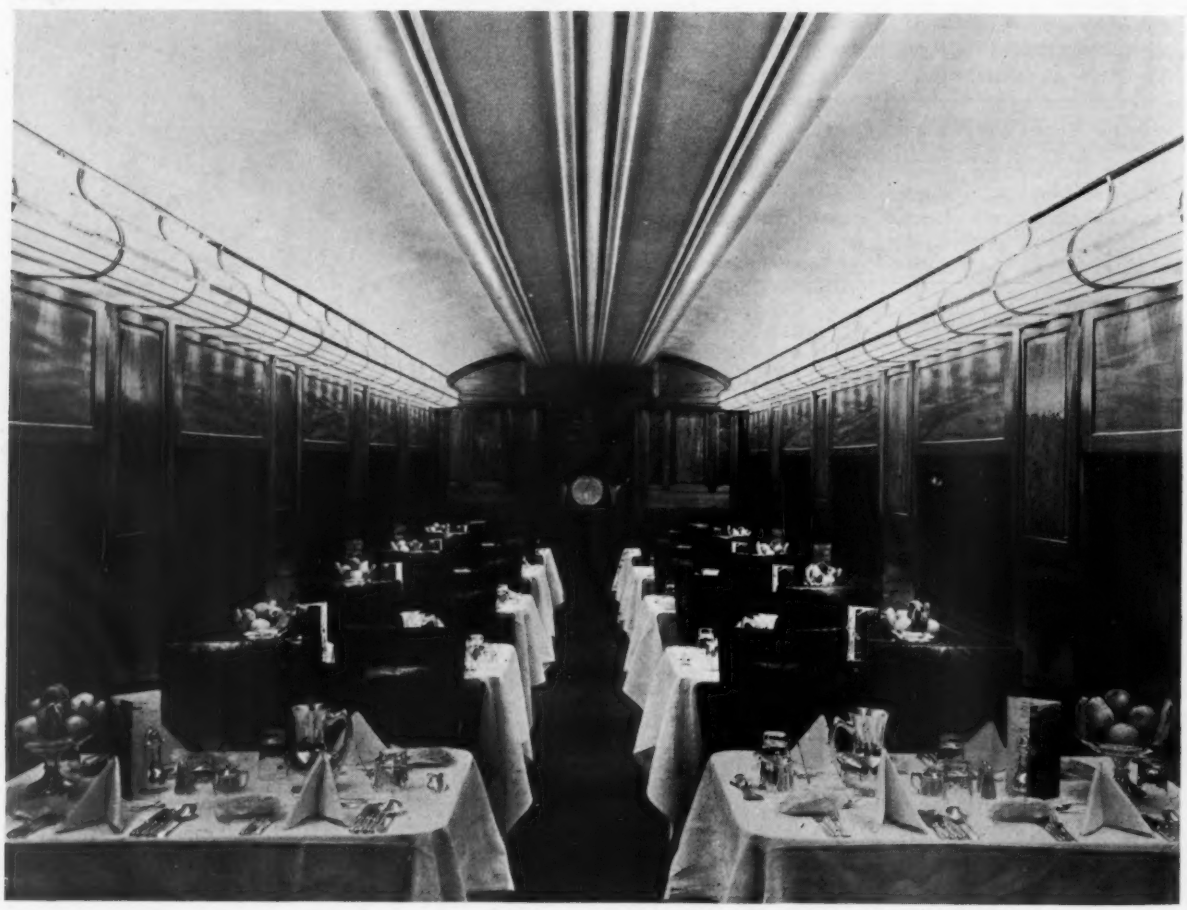
New Netherlands Streamlined Express Locomotive

One of a standard class of 4-cylinder simple 4-6-0 locomotives of the Netherlands Railways, No. 3804, which has recently been streamlined. Tests showed that at 100 km.p.h (62 m.p.h.) an increase of 20 per cent. in power was obtained compared with a similar unstreamlined locomotive (*see page* 649)

General view of air-conditioned passenger car



General view of air-conditioned dining car; it has seating accommodation for 48



Interior view of air-conditioned dining car, Victorian Government Railways

AIR-CONDITIONING ON THE VICTORIAN RAILWAYS

AIR-CONDITIONING ON THE VICTORIAN RAILWAYS

Success of the first properly air-conditioned passenger vehicles in the British Empire leads to decision to instal air-conditioning of British manufacture on further vehicles

As we announced in our issue of March 13, a large sum of money has been allocated by the Victorian Railways Department for the provision of a new all-steel air-conditioned train for the Melbourne-Albury section of the route connecting Melbourne and Sydney. The decision to equip this train with air-conditioning plant has been taken as a result of the success achieved with an experimentally air-conditioned car placed in service shortly after the return from his world tour last year of Mr. Clapp, Chairman of the Victorian Railways Commissioners. On that tour Mr. Clapp thoroughly investigated the subject of air-conditioning and found that, although most of the air-conditioning of railway passenger vehicles had been carried out in the U.S.A., a completely English plant designed by J. Stone & Co. Ltd., of Deptford, had been developed, incorporating all the latest refinements. Orders were therefore placed with this firm to supply two air-conditioning equipments for fitting to existing cars as an experiment. These were the first properly air-conditioned cars operating in regular service on a revenue earning basis in the British Empire. As a result of the success of these cars the Victorian Government Railways have placed repeat orders for a further 26 similar equipments, some of which will be installed on the Melbourne-Albury train.

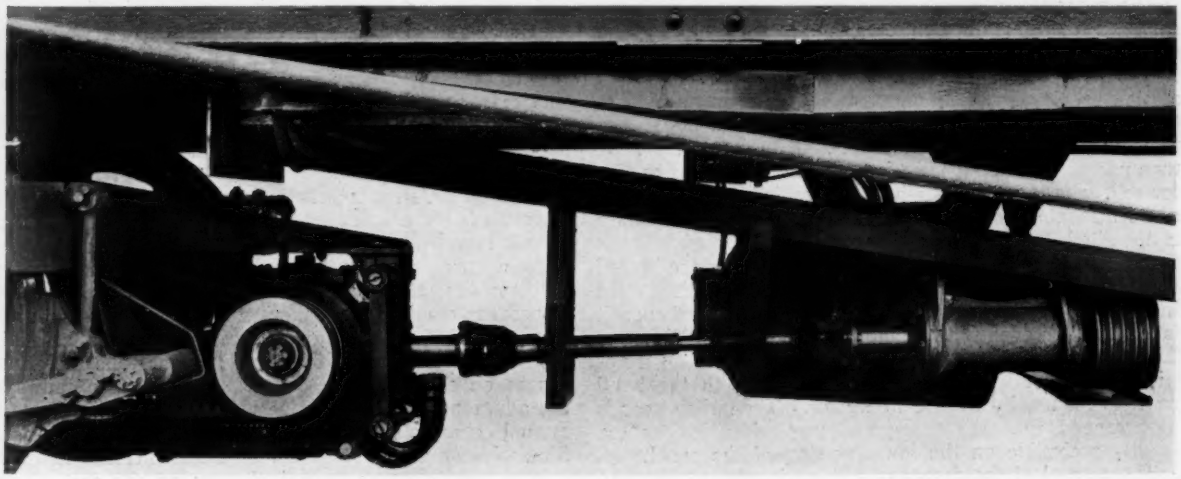
The equipment supplied was in the form of compact units, so constructed that they could readily be fitted either to existing stock or new cars. As his first installations, Mr. Clapp decided to recondition an existing steel dining car and an "AE" class wooden compartment car. The illustrations show how the work has been carried out, and the modern and attractive appearance of the dining car interior will be noted. The system adopted provides for full air-conditioning, that is to say, the temperature, humidity, purity, and movement of the air is controlled within agreeable limits, relative to the outside weather. Another most important feature is the great reduction of noise obtained by the provision of fixed double windows.

In hot, dusty weather, the air is cleaned, cooled, and dehumidified, and circulated throughout the car to maintain a refreshing atmosphere. During cold weather the converse operation takes place, except that the air is not humidified, for the reason that cold weather is very rare in Victoria, and in any case not severe. The equipment, which normally would provide also for humidifying the warmed air, was supplied by J. Stone & Co. Ltd., in collaboration with the Lightfoot Refrigeration Co. Ltd. The principal components are:—

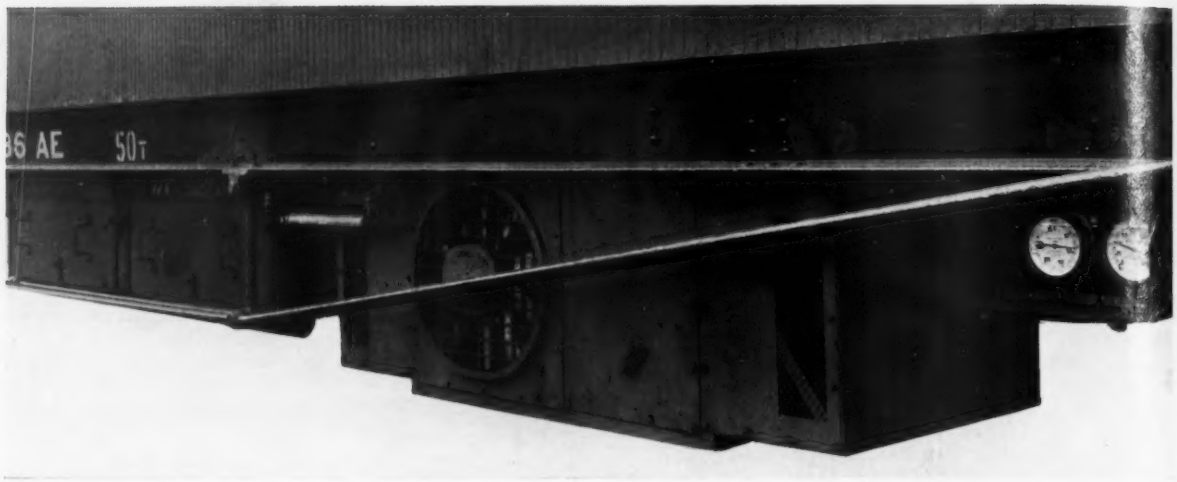
Generator gear drive	Generator
Battery	Refrigerating unit
Air-conditioning unit	Control panel

The illustration below shows the generator gear drive, attached to the bogie headstock, together with the propeller shaft and generator. The patented gearbox consists of a special Ceralumin casing containing a pair of spiral bevel wheels. The drive from the axle is taken to the main shaft of the gearbox by means of vee rubber and canvas belting. There are six belts on these drives, three on each side of the gearbox, and easily detachable fasteners facilitate replacements when necessary. As the gearbox is suspended on the bogie headstock, the belts have a positive and definite drive. Tension on the belts is applied automatically by means of compression springs which can be plainly seen beneath the gearbox. The drive from the output shaft of the gearbox to the generator is by means of a telescopic propeller shaft fitted with universal joints, which compensate for the movement of the gearbox relative to the generator.

The generator is hung from the underframe by means of feet which are cast integral with the yoke. The yoke is constructed of cast steel and is fitted with special Elektron end covers in order to save as much weight as possible. It is to be noted that in the drive illustrated, the car is fitted with centre truss angles, and so it was necessary to mount the generator at one side of the car, and to take the final drive to this from the propeller shaft across the underframe by means of endless vee belts. The battery



View showing the gearbox, and the pulley on the countershaft driving the generator



View of the underframe unit of the air-conditioned car, comprising compressor and condensers. The fan of the condensers can be seen behind the grid. The battery box and also the gauges used in conjunction with the underframe unit can also be seen. The cylindrical pipe adjacent to the left hand condenser and the battery box is the dehydrator

comprises 24 special lightweight cells of the No Wash type.

The refrigerating unit is suspended beneath the underframe, as seen above, which shows the construction of the containing frame and covers. Within the frame is housed a twin-cylinder vertical compressor, designed for the use of Freon (a non-toxic refrigerant), an electric motor for driving the compressor, and a condenser for the refrigerant, made in two equal sections. The compressor has a capacity of 5½/7 tons and is especially constructed for railway use; it is very robust and is fitted with both high and low pressure devices which close down the plant in event of abnormal pressures being developed.

The electric motor, also designed for minimum weight, is totally enclosed, and is built on similar lines to the generator, except that the frame is of fabricated construction. On each end of the motor shaft is mounted a cast Elektron fan. These fans draw air into the unit and pass it through the two sections of condenser, one of which is mounted at each end of the unit. The warmed air is discharged into the atmosphere at right angles to the direction of motion.

The air-conditioning unit is situated in the roof of the car and consists of a steel framework containing an evaporator coil, a bank of electric heating elements, and two multivane centrifugal air circulating fans, driven from a totally-enclosed electric motor mounted on an anti-vibration base. Air is drawn into the car through a bank of filter units which extract the dust and foreign matter. It then passes into the fans and is forced through the evaporator coil, where, in hot weather, it is cooled, and by virtue of its intimate contact with the large plate fins, moisture is deposited, thus lowering the humidity. In cold weather the air is raised in temperature by passing over the heated electrical elements. Leaving the unit, the air is discharged into the car from ducts above the car ceiling, whence it is distributed evenly throughout the length of the car. The control gear is all mounted on one panel, in front of which is a small and compact sub-panel with the hand controls for use by the car attendant. The switch gear is so arranged that the fuses and protection devices are readily accessible on the lower portion of the panel.

The control of the degree of cooling is effected by stopping and starting the compressor motor through thermostatic controls operating an automatic contactor starter. Similarly, the heating units are operated thermostatically through temperature and contactor switches. Both the heating and cooling contactors are interlocked, and all the controls are centralised on the one main panel. Should the outside atmospheric conditions be favourable, the ventilating fan can be operated alone, supplying the car with an adequate quantity of cleansed fresh air.

The equipment is started up about half-an-hour before the train is due to depart, either to pre-cool or pre-warm the interior evenly. Current is either taken direct from the batteries on the car, or supplied to the equipment from an external source by plugging into sockets provided on the solebars. Once the plant is switched on by the car attendant, it will continue to operate automatically and maintain the car interior at the desired temperature level, irrespective of whether the train is in motion or at a station.

Great interest has been shown in these first air-conditioned cars in Australia, which have now completed a considerable mileage with, we understand, entire success. From the point of view of travel comfort, Mr. Clapp claims that a new era has been opened up in his country, and the popularity of these cars with the public can be judged by the fact that the 12 coaches of the new Cor-Ten train now under construction for the Sydney Limited service are to be similarly equipped. In addition, a further 14 sets have been ordered for delivery in Victoria by October this year. Enthusiastic letters of appreciation have been received by Mr. Clapp from the Prime Minister of Australia, and from countless passengers after their first experience of this new development in rail travel.

As a result of experience gained during the operation of these first two cars, the Victorian Railways Commissioners are emphatic that the introduction of air-conditioning is justified, and they say that, taking as a basis the section from Melbourne to Albury, if only one more passenger on each journey were attracted to the railways, the additional annual revenue would more than offset the annual charges on the cost of equipping two cars. Similarly, on other lines, a very small increase in traffic will suffice to cover annual charges on the cost of the equipment.

IMPROVEMENTS AT DONCASTER WORKS, L.N.E.R.

Reconstruction of the Flanging shop and reorganisation of the plant

THE increasing dimensions of modern locomotive boilers, and the desire to obtain the greatest possible amount of heating surface in the firebox, have brought many problems, not the least of which has been the flanging of the various plates, the sizes of which have increased, whilst the shapes have become more complicated. For many years an hydraulic press capable of exerting a pressure of 200-300 tons was found to be quite capable of dealing with the flanging of all plates required in the boiler shop, but the extension of the firebox beyond the width of the frames and into the boiler barrel, in order to obtain increased firebox heating surface, demanded that larger hydraulic presses should be installed.

The need for a larger hydraulic press having arisen at the Doncaster works of the London & North Eastern Railway for flanging boiler throat plates, it was decided to reorganise the whole of this department in order to obtain more floor space, together with adequate lifting appliances and the installation of modern furnaces. To provide for this it became necessary to demolish practically the whole of the existing flanging shop and to erect a suitable building which would adequately house the two existing hydraulic presses and a large new press capable of exerting a pressure of 750 tons, together with three new furnaces and an electric overhead crane of 10 tons capacity. In the demolition of the old building and the erection of the new one, care had to be taken to avoid interference with the normal production of the shop, and the arrangements made were such that the production of the shop was completely stopped on one day only, this occurring when the old coal-fired furnace was demolished.

An idea of the relative sizes of the old and new buildings may be gained from the drawings and illustration reproduced.

Details of the Plant

The result is that Doncaster works is now well equipped for the flanging and pressing of all steel and copper plates used for locomotive boiler and locomotive construction. The equipment consists of three hydraulic presses, operating at a water pressure of 1,500 lb. per sq. in., and three oil-fired furnaces with the necessary storage tanks for fuel oil, &c. All are housed in the new building and served by a 10-ton electric overhead travelling crane.

The largest press is of 750-tons capacity and was supplied by Henry Berry & Co. Ltd., Leeds. The tables of this press are 10 ft. wide by 12 ft. 6 in. long, and a maximum daylight of 10 ft. is obtainable. The stroke of the main rams is 6 ft. and power is applied through three rams 20 in. in diameter. Two water-saving rams 7⅞ in. diameter, and four vicing rams, each 6½ in. diameter and 3 ft. stroke, and adjustable radially, are fitted. The table is raised by the water saving rams until the flanging blocks grip the plate to be flanged. During this portion of the stroke the main ram cylinders are being filled with slack water from the reservoir tank. The main cylinders are then brought into use, supplied with high pressure water, and the operation completed. This feature effects a considerable saving of high pressure water. The centre ram of the three main rams may be used independently of the two outer ones for vicing or small flanging operations. The two outer main rams may also be used

General view of the new flanging shop and its equipment at Doncaster Works, L.N.E.R.

independently of the centre ram. A selection of three powers is thus available, enabling the press to be worked economically on a large variety of work.

This press is served by an oil furnace, supplied by James Howden & Co. Ltd., Glasgow, which has a width of 12 ft., a depth of 11 ft., and a height of 3 ft. 9 in. The 750-ton press deals with all the largest pressings required, and the illustration shows the flanging blocks for a steel throat plate of a "Silver Link" class Pacific fitted to the press tables. A pressed plate is shown in the centre of the illustration, directly in front of the press, the pressing and flanging of this plate being accomplished in one operation.

Medium size work such as boiler back plates for smaller boilers is dealt with by the press on the extreme left of the illustration. This press was supplied some time ago by Fielding & Platt Limited, of Gloucester, and is capable of exerting a pressure of 210 tons. It has been completely overhauled, and the ram packing arrangements modernised. Water-saving gear, supplied by Hugh Smith & Co. (Possil) Ltd., has also recently been fitted to this press. The 210-ton press is served by an oil furnace supplied by James Howden & Co. Ltd., Glasgow. This is of similar dimensions to the one serving the 750-ton press, so that in the event of one of the furnaces requiring, say, repairs to the brick lining, large plates can still be dealt with. Large plates can also be dealt with on the 210-ton press when the force required is within its capacity. Small work is dealt with on a 110-ton press made at Doncaster works. This press is not shown in the illustration, but the new oil furnaces serving it, supplied by James Howden & Co. Ltd., Glasgow, can be seen on the right, below the crane hook. The furnace is approximately 5 ft. 6 in. wide, 9 ft. deep and 2 ft. high.

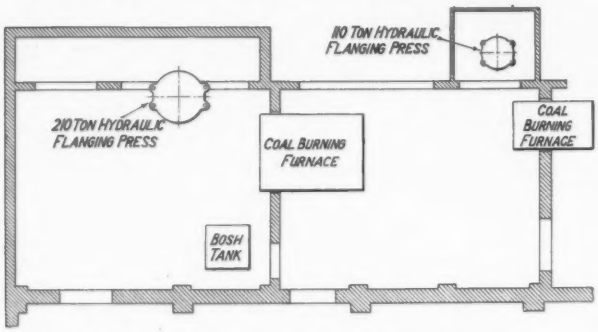


Fig. 1—Flanging shop as originally arranged

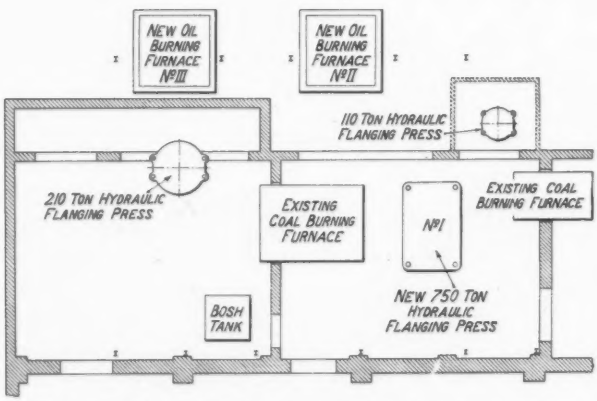

NEW OIL BURNING FURNACE No III
NEW OIL BURNING FURNACE No II
110 TON HYDRAULIC FLANGING PRESS
210 TON HYDRAULIC FLANGING PRESS
EXISTING COAL BURNING FURNACE
EXISTING COAL BURNING FURNACE
No I
NEW 750 TON HYDRAULIC FLANGING PRESS
BOSH TANK

Fig. 2—Plan adopted for converting the shop without interfering with the work

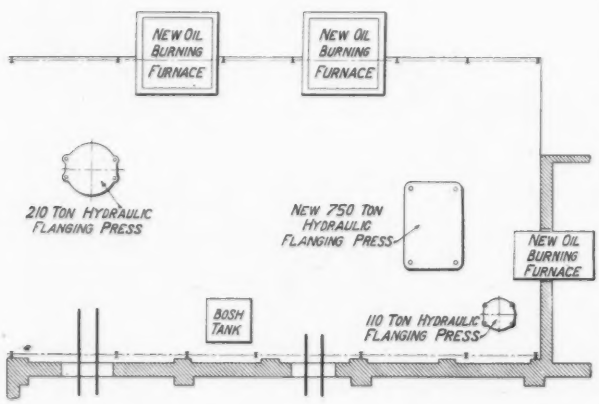

NEW OIL BURNING FURNACE
NEW OIL BURNING FURNACE
210 TON HYDRAULIC FLANGING PRESS
NEW 750 TON HYDRAULIC FLANGING PRESS
NEW OIL BURNING FURNACE
BOSH TANK
110 TON HYDRAULIC FLANGING PRESS

Fig. 3—Layout of shop and plant as now arranged

The shop is equipped with a 10-ton electric crane, with pendant controls, which, with the gantry and steel building, was supplied by the Clyde Crane & Engineering Co. Ltd. The gantry extends beyond the shop, and flanging blocks are stored under the crane and conveyed direct to the press when required, and plates may be readily conveyed to and from the furnaces and presses. Oil fuel is stored in six oil tanks, the tops of which are at ground level, and is pumped into small auxiliary tanks, one tank to each furnace, by a Nuflo electrically-driven pump, supplied by Worthington Simpson Limited, Newark.

Reconstruction of the Building

As already stated, the production of flanged plates was interrupted for one day only during the demolition of the old building, the erection of the new building, and the installation of the presses and furnaces. The pre-arranged sequence of operations in the rebuilding and rearrangement of the shop is indicated by the three diagram drawings. Fig. 1 shows the layout before the alterations were taken in hand, and Fig. 2 how the stanchions of the new building and gantry were placed in position without interfering with the work of the 210-ton press. The 110-ton press was then taken out for reconditioning. That half of the building covering the site for the new 750-ton press, and the existing coal furnace, were then demolished, enabling part of the new building and the crane to be erected. The foundations for the new 750-ton press were next put in hand, and owing to the close proximity of the river Don, water was soon encountered. The quantity of water proved too much to be dealt with by a diaphragm hand pump, and a Quinby pneumatic sump pump was purchased from the Consolidated Pneumatic Tool Co. Ltd., this being capable of dealing with 160 gall. of water per min., which was adequate to cope with the situation.

The foundations were sunk some 23 ft. below ground level, and owing to the presence of water, all the concrete was made of Cement Fondu, which sets in 24 hr. The concrete was heavily reinforced with old steel rails and joists, particular care being taken to reinforce the concrete blocks on which the press would rest when installed. The blocks were bonded into the side walls and floor by heavy reinforcing. The press was then erected on the foundations, great care being taken to see that it was level and that the weight of the press, some 100 tons, was evenly distributed on the blocks. It is of interest to note that the bottom casting of the press weighs approximately 24 tons, and that only a 10-ton crane was available for lifting. The difficulty was overcome in the following manner. The foundation was filled up to floor level with wood packing. The bottom casting was then jacked into

position on rollers and one end of the casting lifted by the crane. The packing was next taken out from under the suspended end and the casting lowered, the other end being then lifted and the operation repeated. By repeated lifting and lowering at each end of the casting alternately, and adjusting the packing, the casting was lowered to the foundation a few inches at a time, and as the fulcrum was near the centre of the casting, the load on the crane never exceeded 9 tons. The table and head casting, each weighing over 20 tons, were placed in position in a similar manner. The oil furnace (Fig. 2, No. II), was then installed, and the press connected to the hydraulic mains and fuel supply.

It was at this stage that production was stopped for one day whilst the coal furnace was demolished. The flanging of plates now proceeded on the new 750-ton press, fed by the oil furnace II, whilst the demolition of the remaining half of the old building and the erection of the new building and extended crane gantry was completed.

The second large oil furnace (Fig. 2, No. III) was installed, and the 210-ton press taken out, reconditioned and modernised. New foundations were then put in for both the 210-ton and 110-ton presses; the presses were reinstalled on their new sites, and the small oil furnace serving the 110-ton press put into commission. Fig. 3 shows the present arrangement of the shop.

It was considered necessary to instal a new pump to augment the supply of hydraulic pressure water to the flanging shop and all other hydraulically operated machinery in these works. The pump was supplied by Fullerton, Hodgart & Barclay Limited, and the motor by Laurence Scott & Electromotors Limited. The control gear, by the Igranic Electric Co. Ltd. is of the three-ram type and supplies 70 gall. of pressure water per min. at 1,500 lb. per sq. in. Power is transmitted from the motor to the pump by single reduction double helical gears. The pump is fully automatic in operation, a bye-pass valve being controlled by the rise and fall of the accumulators.

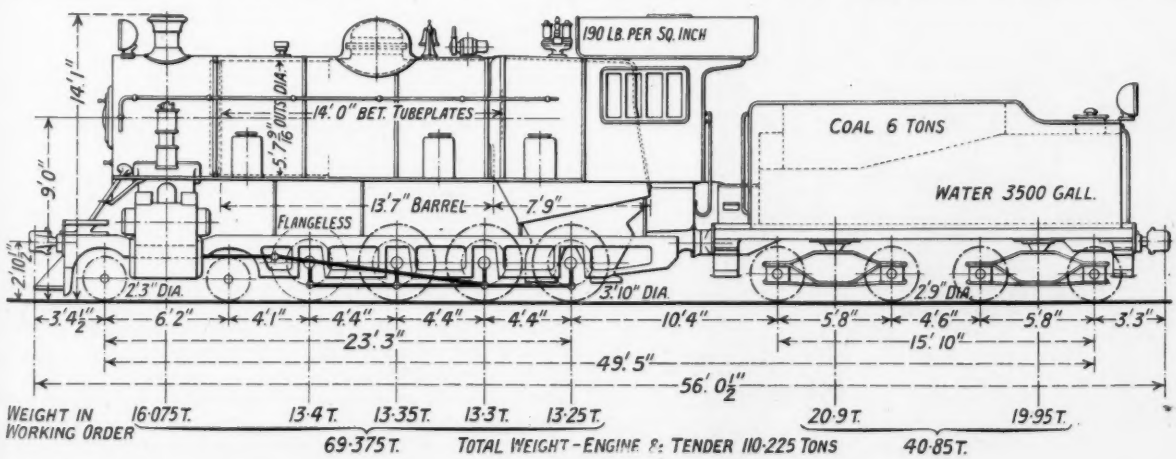
NEW 4-8-0 TYPE LOCOMOTIVE, JAMAICA GOVERNMENT RAILWAY

Severe grades and curves of small radius are factors influencing the design of this engine

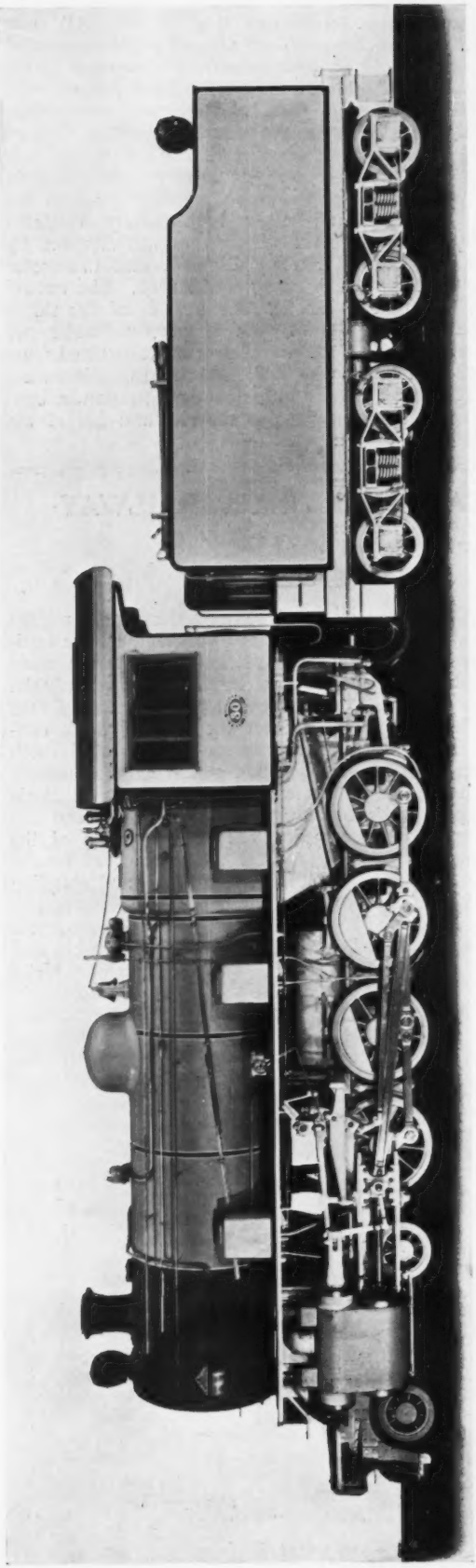
TO the order of the Crown Agents for the Colonies, on behalf of the Jamaica Government Railway, and to the requirements of the Locomotive Superintendent, Mr. P M. McKay, a 4-8-0 locomotive, No. 30, has just been built and shipped, by Nasmyth, Wilson & Co. Ltd., Patricroft, Manchester. It is constructed on the American pattern with bar framing, &c., but contains a number of British features.

The cylinders are placed outside the frames and the drive is taken by the third pair of coupled wheels. Steam distribution is effected by 10-in. inside admission piston valves, with Walschaert valve gear. The cylinders and steam chests are cast separately from the smokebox saddle, but bolted to the frames and each other, so as to form a very rigid structure. King type metallic packings, of the United States Metallic Packing Co. Ltd., are fitted to the piston rods. A drifting valve is provided on the firebox back with connections to the main steam pipes at the cylinders, and bye-pass valves are mounted on the steamchests. The reversing gear is operated by a hand lever. The bar frames are cut from solid forged steel, and have a thickness of 4 in. To allow for the necessary flexibility in an eight-coupled engine, and the negotiation of curves as small as 3½ ch. radius, the leading coupled wheels are flangeless, and allowance is made for lateral movement of the trailing coupled wheels. This reduces the rigid wheelbase to 4 ft. 4 in., and thus enables the locomotive to meet the difficult track conditions. The coupled axleboxes are of cast steel, with bronze bearings, and the axlebox guides have adjustable wedges and slides of bronze. The coupled and bogie bearing springs are of chrome vanadium steel and the coupled springs are compensated. The bogie is of the swing link type with cast steel axleboxes and bronze bearings. The large end of the connecting and coupling rods have floating bushes of bronze, and lubrication is effected through hard grease nipples. The motion details also have bronze bushes. All bronze used for bushes and bearings, &c., was supplied by the Anti-Attrition Metal Company.

The boiler, the centre line of which is 9 ft. 0 in. above rail level, has a diameter next the smokebox of 5 ft. 6¼ in. inside, and the length between the tubeplates is 14 ft. 0 in. The boiler is of steel throughout and carries a working



General arrangement drawing of new 4-8-0 locomotive, Jamaica Government Railway



New 4-8-0 type locomotive for service on severe grades and curves on the Jamaica Government Railway

pressure of 190 lb. per sq. in. The tubes are of solid cold drawn steel and the superheater is of the Melesco type supplied by the Superheater Co. Ltd. The smokebox is fitted with a spark arrester. The firebox is fitted with a rocking and drop grate, both operated from the footplate, and a brick arch, carried on lugs, welded to the inside of the firebox. Bottom sliding doors are fitted to the ashpan, so arranged that they can be operated only from the ground. Ashpan and coal watering sprinklers are provided, these being controlled by cocks in the cab. Flexible steel stays are fitted in the breaking zones in the firebox and also in the first three rows of the roof stays; the remaining side stays are of Longstrand steel. There are two Ross pop safety valves, and near them is located the whistle, turbo generator and bell.

The boiler is fed by two 9½-mm. self acting lifting injectors of the Sellers M improved type, supplied by Davies & Metcalfe Limited, one on each side of the firebox in the cab, which deliver through a top feed clackbox, placed at the front end near the smokebox. An Owen double beat type regulator, having a pull-out handle with a sector and catch, is provided, and a Wakefield's Eureka five-feed sight-feed lubricator with connections to the cylinder barrels, steam pipes and brake pumps. There are two glass water gauges, alongside which are three test cocks and a drain. A Clyde Superior steam soot blower is mounted on the firebox back, along with the driver's brake valves, the handwheels and spindles controlling the various steam valves, such as injector, lubricator, soot blower, &c.; all are within convenient reach. The sanding of the coupled wheels is arranged for both compressed air or hand operation, controlled from the cab, the pipes leading to the front of the leading and driving and the rear of the trailing coupled wheels.

The cab is roomy and provided with doors in the front, sliding windows at the sides, back drop window, and two upholstered seats. Its roof is extended well back over the footplate and affords plenty of protection to the fireman when shovelling coal. Other items of equipment are an eight feed Wakefield mechanical lubricator to feed the coupled axleboxes, automatic couplers, A.A.R. No. 10 contour, supplied by the English Steel Corporation, J. Stone & Company's electric lighting equipment, J. W. Roberts magnesia sectional lagging on the boiler, firebox and cylinders, Deurance water gauges, Westinghouse 6.E.T. air brake on engine and tender, and Teloc speed indicator and recorder.

The following are the principal dimensions:—

Cylinders, diam.	19 in.
Piston stroke	26 in.
Wheels, coupled, diam.	3 ft. 10 in.
Bogie	2 ft. 3 in.
Wheelbase, coupled	13 ft.
,, rigid	4 ft. 4 in.
Total engine	23 ft. 3 in.
Boiler, working pressure	190 lb. per sq. in.
Heating surface:—	
Tubes	1,275 sq. ft.
Flue tubes	552 ,,
Firebox	146 ,,
Superheater elements	405 ,,
Combined total	2,378 ,,
Grate area	33 sq. ft.

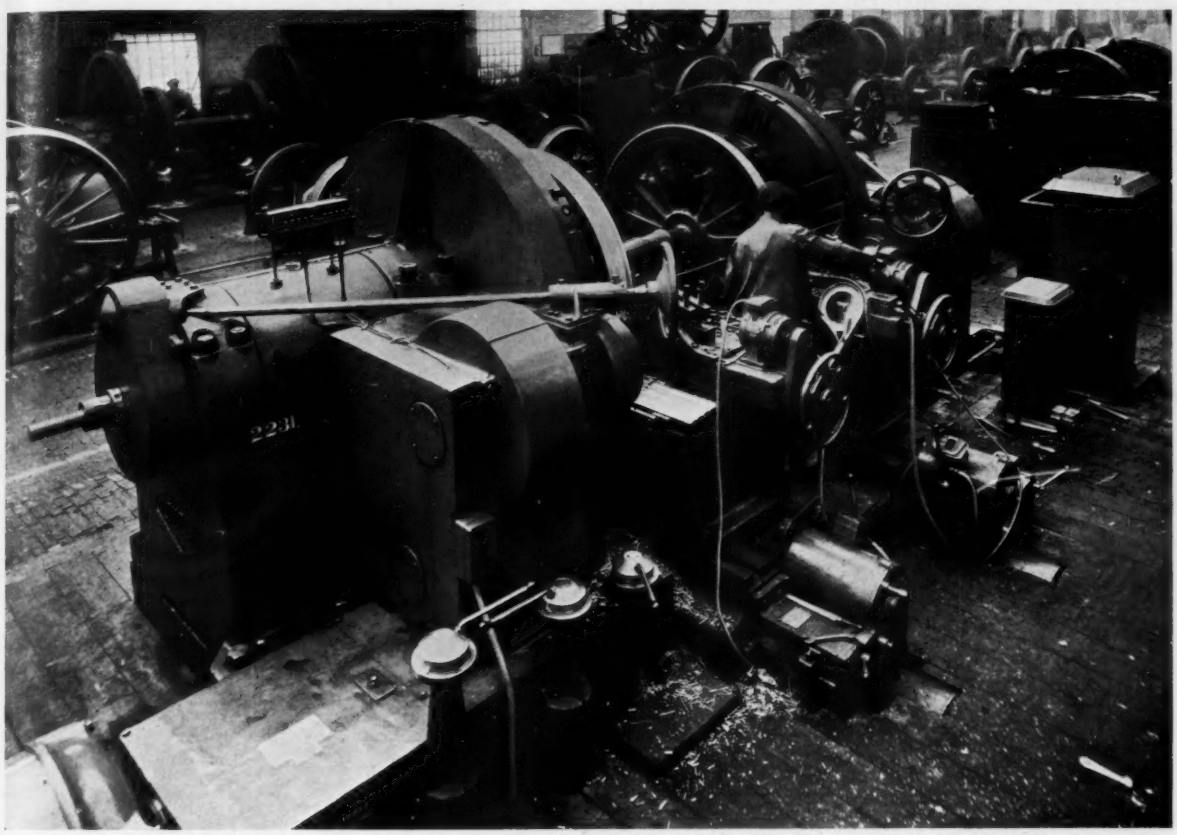
The total weight of engine and tender in working order is 110·2 tons, distributed as shown on the outline drawing. The engine develops a tractive effort at 85 per cent. of the boiler pressure of 32·953 lb., and the ratio of adhesion to tractive force is 3·62.

The tender is carried upon two diamond frame four-wheeled bogies; it has a fuel capacity of 6 tons and a water capacity of 3,500 gallons. The tank is of all-welded construction, and the bogie axleboxes have British Timken tapered roller bearings.

TURNING LOCOMOTIVE WHEELS

THE lathe illustrated and described* is a Loudon super-speed heavy duty wheel lathe in use at the Crewe works of the L.M.S.R. for turning locomotive wheels. The lathe is driven by a variable speed motor through a speed-reducing gear box fitted with roller bearings. The headstocks are fitted with adjustable gunmetal capped bearings for the main spindle, which has heavy ball thrust washers. The bed is designed so that cuttings fall into a hopper let into a foundation at the back of the machine. The slide rests are of the multiple tool type; the tool lay-out comprising triple roughing tools, combined flange roughing, chamfering and side cutting tool, and full width forming blade to each rest.

Positive, reversible, and continuous geared feed motion is applied to each rest, giving a range of feeds suitable for both high-speed steel and alloy cutting tools. The lathe is controlled by conveniently placed push buttons, whilst the slide rests are also fitted with quick power traverse to all motions. The machine will take wheels up to 7 ft. 0 in. dia., and in the photograph it is seen re-turning a pair of 6 ft. 0 in. dia. locomotive wheels, high-speed steel tools being used.

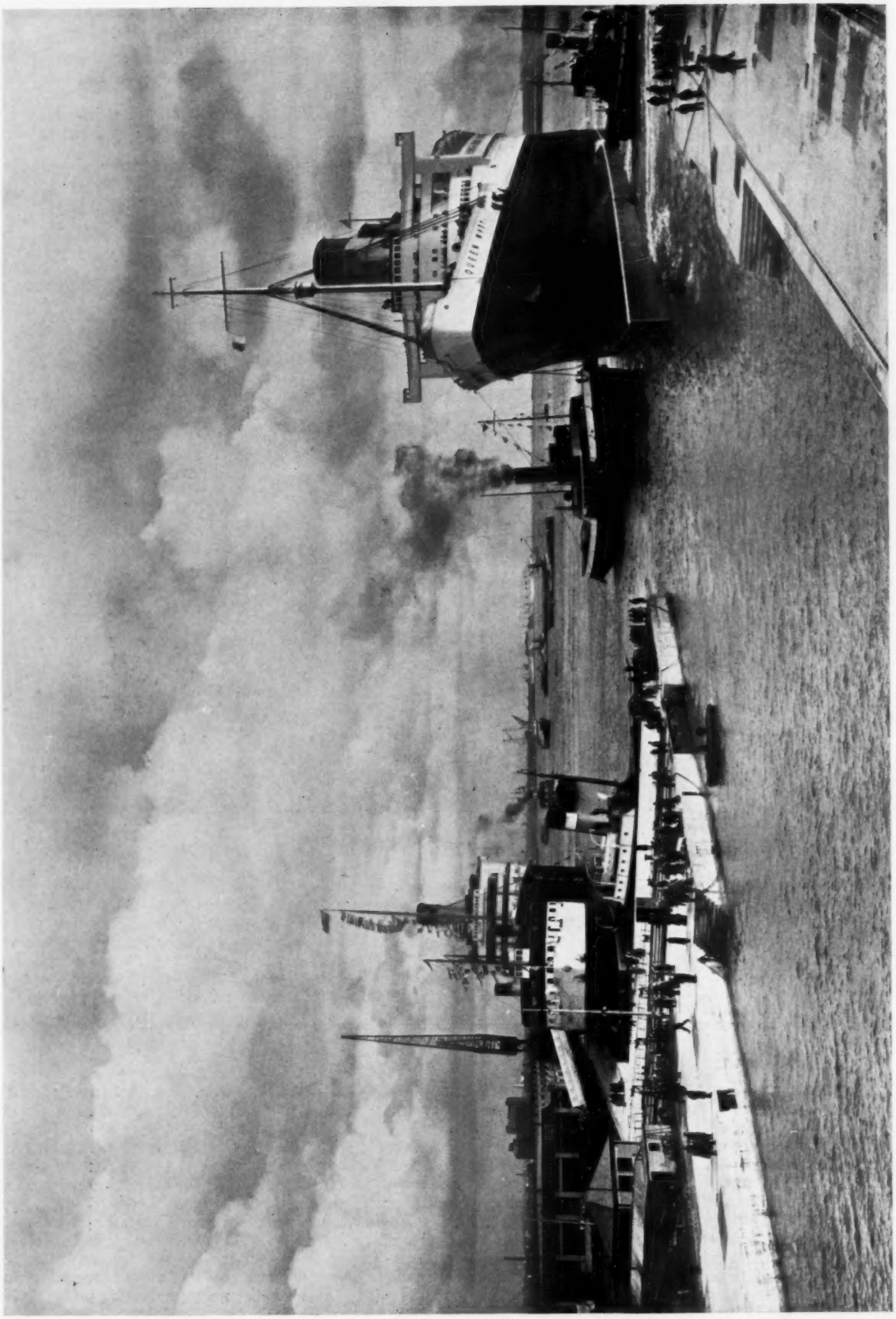


Loudon 7-ft. wheel lathe turning a pair of 6-ft. diam. locomotive wheels

* By courtesy of Mr. W. A. Stanier, Chief Mechanical Engineer, London Midland & Scottish Railway.

The Huey P. Long Bridge

The name of Huey P. Long, to whose election in 1918 as Railroad Commissioner from North Carolina we referred in an obituary notice in our issue of September 13 last, now has a more lasting link with railways in that it has been given to the recently opened road and rail bridge across the Mississippi which replaces a former train ferry. The Huey P. Long bridge, which was opened on December 16, 1935, is the only structure to span the Mississippi south of Vicksburg, 370 miles up-stream, and will save Southern Pacific trains from 30 minutes to an hour in entering and leaving New Orleans. The opening ceremony was therefore of particular significance in American railway history, and the Southern Pacific Company marked the occasion with an appropriate pageant of progress. The official train was followed on its inaugural journey across the bridge by the little wood-burning single driver of the 1860's, *C. P. Huntington*, which continued in service almost to the end of last century and is still maintained in running order for exhibition and motion picture purposes. The *Brotherhood of Locomotive Firemen and Enginemen's Magazine* reports that the engine was in charge of Driver W. T. Donner, who is the oldest employee in length of service on the Southern Pacific. Two modern locomotives and a second special train brought up the rear of the procession. The bridge, with its railway approaches, is 4·4 miles long.



The "Queen Mary" arrives at the King George V Dock on March 27. Near the dock entrance are the Southern Railway steamer "Twickenham Ferry" and the Cunard White Star liner "Majestic". *(See news article on page 679)*

(By courtesy of "The Times")

RAILWAY NEWS SECTION

PERSONAL

Mr. H. N. Anderson, Assistant to the General Manager, B.A.G.S. and B.A. Western Railways, has been appointed General Manager of the B.A. Midland Railway as from April 1. Mr. Anderson entered the service of the B.A.G.S. in 1900 as a junior clerk, and occupied various posts in the management until the outbreak of the war, when he joined the British Army. He served with the Royal Scots in Salonica, and in 1918, went to Mesopotamia as Personal Assistant to his former Chief, Major-General R. de Candolle, C.B., Director-General of Transportation. He also afterwards accompanied him to Constantinople, where he transferred to the Military Control and Operating Staff of the Anatolian Railway, occupying the position of Assistant Manager, with the rank of Major, which he now retains in the Regular Army Reserve of Officers. In 1921, Mr. Anderson rejoined the B.A.G.S. as Personal Assistant to the General Manager, and in September, 1928, was promoted to be Assistant to the General Manager. When Mr. C. R. S. Harris was appointed Director-General of the B.A.G.S. and B.A. Western Railways in July last, Mr. Anderson was selected as his Assistant, and this position he continues to occupy in conjunction with his new post of General Manager of the Midland Railway. In this connection it may be recalled that in May, 1931, the B.A. Midland Railway—which is 322 miles in length, and since 1910 had been worked jointly by the B.A.G.S. and B.A. Western Railways—was taken over entirely by the latter company, with the consent of the Provincial Government. (As recorded in THE RAILWAY GAZETTE of June 5, 1931.)

Mr. H. N. Anderson,
Appointed General Manager, Buenos Ayres Midland Railway

Mr. T. B. Stewart,
Appointed Traffic Manager, B.A.G.S and B.A.W. Railways

Mr. W. A. J. Day,
Appointed Chief Mechanical Engineer, South African Railways and Harbours

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Mr. T. B. Stewart has been appointed Traffic Manager, B.A.G.S., and B.A. Western Railways as from April 1, in place of Mr. John Wilson, O.B.E., who, as already recorded, has been appointed General Manager, Entre Rios & N.E. Argentine Railways. Mr. Stewart has been actively connected with British-owned Argentine railways since January, 1910, when he joined the staff of the Railway Clearing House in Buenos Aires. After serving as Chief of the Tariff Section, he was appointed Chief of the Hotels and Refreshment Department of the B.A.G.S. Railway, in October, 1918. In 1928 he was promoted to be Assistant to the General Manager, in charge of staff and labour matters, in addition to occupying the position of Chairman of the Labour Advisory Committee of all the foreign-owned railways in the Argentine.

Mr. F. D. Southgate, Running Superintendent of the Argentine North-Eastern and Entre Rios Railways, has arrived in this country on three months' leave.

Mr. W. A. J. Day, Assistant Chief Mechanical Engineer, South African Railways and Harbours, has been appointed to succeed Mr. A. G. Watson as Chief Mechanical Engineer.

Before going out to South Africa, Mr. Day was on the staff of the London & North Western Railway, and joined the Transvaal Railways in 1902. He rose to be Assistant Mechanical Engineer, Durban, in 1918, and in 1927 was promoted to be Mechanical Engineer, Maritzburg. In the following year he was transferred to Uitenhage in a similar capacity, and in 1930 was appointed Advisory Engineer to the High Commissioner at South Africa House, London. In December, 1932, Mr. Day returned to South Africa to take up the appointment of Mechanical Engineer on the staff of the Chief Mechanical Engineer at Pretoria, and in 1935 was promoted to be Assistant Chief Mechanical Engineer, the grade from which he is now promoted to be Chief Mechanical Engineer. Mr. Day is an Associate Member of the Institution of Mechanical Engineers and a Member of the Institution of Locomotive Engineers and owing to his comparatively recent tenure of office at South Africa House, is well known in this country.

G.W.R. APPOINTMENTS

The directors of the Great Western Railway have approved the following appointments:—

Mr. K. W. C. Grand, General Assistant to the Superintendent of the Line, Paddington, to be Divisional Superintendent, Swansea, as from May 4.

Mr. E. A. Glayzer, Chief Clerk, Office of Superintendent of the Line, to be Staff and General Assistant to the Superintendent of the Line, as from April 6.

Mr. A. H. Bird, Clerk, Office of

"Twickenham Ferry" and the Cunard White Star liner "Majestic" (See news article on page 679)

Superintendent of the Line, to be Chief Clerk, Office of Superintendent of the Line, as from April 6.

Mr. G. S. Hodder, Chief Clerk, Parcels Department, Bristol, to be Parcels Agent, Bristol, as from March 31.

Mr. W. N. Spendlove, Goods Agent, Port Talbot, to be Goods Agent, Llanelly, as from April 1.

Mr. J. H. Roake, Chief Clerk, goods station, Bristol, to be Goods Agent, Port Talbot, as from April 1.

Mr. S. Y. Richards, Chief Clerk, Goods station, Swansea, to be Chief Clerk, goods station, Bristol, as from April 1.

Mr. G. O. Thomas, Clerk, District Goods Manager's office, Swansea, to be Chief Clerk, goods station, Swansea, as from April 1.

Mr. K. W. C. Grand,

Appointed Divisional Superintendent, Swansea, G.W.R.

Mr. K. W. C. Grand, who, as announced above, has been appointed Divisional Superintendent, Swansea, G.W.R., was educated at Rugby, and joined the company's service in 1919 at Park Royal goods station. After gaining experience there, at Ealing Broadway, and in the Divisional Superintendent's office at Paddington, he was, in 1922, transferred to the General Manager's office. In March, 1926, he was appointed General Agent for the U.S.A. and Canada, and in May, 1929, on his return to England, was appointed Assistant Publicity Agent. On the expiration of the company's trade advertising agreement with its contractor, Mr. Grand was appointed Commercial Advertising Agent, to organise and control the department newly created to deal with this branch of advertising. In January, 1932, on the retirement of Mr. W. H. Fraser, he took over the Publicity Department with the title of Commercial Advertising and Publicity Agent. In April, 1933, Mr. Grand organised the first railway air service which the G.W.R. inaugurated between Cardiff and Plymouth, and subsequently extended to Birmingham. He became Commercial Agent to the Superintendent of the Line in July, 1933, and, 13 months later, was appointed General Assistant, whence he now goes to Swansea.

Warwick [*Brookes*

The late Mr. Gustav Behrens,

Director of the Midland and L.M.S. Railways, 1886-1931, and for twenty years a member of the Permanent Commission of the International Railway Congress

We regret to record the death, at the age of 90, of Mr. Gustav Behrens, who for 45 years was a Director of the former Midland and L.M.S. Railways, retiring in 1931. Mr. Behrens joined the board of the Midland Railway in 1886 and for 20 years also represented British railways at International Railway Congress meetings, his linguistic ability standing him in good stead; consequently his railway services were known all over the world. Referring to Mr. Behrens' retirement, Sir Josiah Stamp (Chairman of the L.M.S.R.), at the general meeting in February, 1931, said that out of the maximum possible attendances at board meetings numbering 672, Mr. Behrens had attended 655, and, of course, thousands of committees. He was, Sir Josiah said, beloved of all his colleagues. Mr. Behrens was

Mr. E. A. Glayzer,

Appointed Staff and General Assistant to the Superintendent of the Line, G.W.R.

Photo] *Railway Benevolent Institution Dinner—View showing some of the guests* [*Swaine*

(*See news article on page* 670)

Senior Partner in the firm of Jacob Behrens & Sons, Bradford, Manchester, London, Calcutta, and Bombay, and was the son of Sir Jacob Behrens its founder. He celebrated his 90th birthday on February 23 last.

Mr. E. A. Glayzer, who, as announced on p. 667, has been appointed Staff and General Assistant to the Superintendent of the Line, G.W.R., was born in 1884. He joined that railway in 1900, taking up an appointment in the Chief Telegraph Superintendent's office at Paddington, and shortly afterwards was transferred to the office of the Superintendent of the Line. Subsequently he was associated with the work in connection with the introduction of the first road and rail motor-car services by the company. He has had experience in various sections of the offices and for some years acted as personal clerk to the late Mr. Charles Aldington. In that capacity he spent several weeks in different divisions in connection with special events. Mr. Glayzer was later appointed to take charge of the general section, where a variety of special subjects had to be dealt with, and, after deputising in that position from time to time for several years, was appointed Chief Clerk in the office of the Superintendent of the Line in August, 1934, the post he now vacates to become Staff and General Assistant.

We regret to record the death, on March 26, of Major John Arthur O'Neill Torrens, D.L., Chairman of the L.M.S.R., Northern Counties Committee (Ireland), in his 82nd year. Major Torrens was educated at Harrow and served in the Royal Scots Greys from 1876 till 1905 and was subsequently Chairman of the Coleraine Harbour Board. He joined the board of the N.C.C. in 1909, was appointed Deputy Chairman later, and, in 1916, became Chairman, the position he held until his death. He was High Sheriff, and later Deputy Lieutenant of the County of Antrim, and was greatly respected throughout Northern Ireland.

The funeral took place at the private burial ground at Cleggan Lodge, Ballymena, and apart from the chief mourners there were present the following :—

The L.M.S. (N.C.C.) was represented by Viscount Massereene and Ferrard, D.S.O., Mr. Thomas Somerset, M.P., Sir Dudley M'Corkell, D.L., and Mr. F. E. Rebbeck, D.L. ; the G.N.R. was represented by the Rt. Hon. J. Milne Barbour, M.P. (Minister of Commerce) and Mr. Maxwell Moore. Also present were Major Malcolm Speir, M.C., Manager and Secretary ; Mr. F. L. Smith, Accountant ; Mr. Malcolm Patrick, Locomotive Superintendent of the N.C.C. ; and Mr. W. K. Wallace, Chief Civil Engineer, L.M.S.R., and Mr. R. L. M'Ilmoyle, his Senior Assistant.

Sir William Barclay Peat, Chairman of Robert Stephenson & Co. Ltd., and for 32 years head of W. B. Peat & Company, chartered accountants, whose death we announced in our issue of January 31, left estate valued at £604,644 (£586,446 net).

Mr. H. Chapman, C.B.E., General Manager, Rhodesia Railways, is at present on a short visit to England.

The death is announced of Mr. Thomas Connolly, for many years Traffic Accountant on the former Great Southern & Western Railway. He retired shortly after the amalgamation of the Free State Railways.

The Court of the University of Manchester, at a special meeting on March 25, authorised the conferment of the honorary degree of Doctor of Science upon Mr. H. N. Gresley, C.B.E., M.Inst.C.E., M.I.Mech.E., M.I.E.E., M.Inst.T., Chief Mechanical Engineer, L.N.E.R.

EASTERN OF FRANCE STAFF CHANGES

In consequence of the retirement of M. Loizillon, Chief Mechanical Engineer, on April 1, the following changes took place on that date :—

M. Poncet, Assistant C.M.E., succeeded M. Loizillon as C.M.E.

M. Bigot, Chief Locomotive Running Superintendent, became Assistant C.M.E., and

M. Oblet, Assistant Locomotive Running Superintendent, became Chief Locomotive Running Superintendent.

In connection with the imminent transfer of the railway system of Iraq to the Government of that country, referred to on page 654, it is expected that Lt.-Col. J. C. Ward, Director of the Port of Basra Authority, will be appointed to succeed Lt.-Col. J. R. Tainsh—who is retiring—as Director of Railways, in addition to his present duties. It is understood that Col. Ward has recommended the unification of the Railways and the Port under a single administration to be controlled by a board composed of both British and Iraqui subjects, states *Great Britain and the East*.

We regret to record the recent death of Mr. Arthur Seymour Pearson, Assistant Goods Manager, York, L.N.E.R. Mr. Pearson, who was 56 years of age, began his railway career as Telegraph and Booking Clerk at Scarborough on the former North Eastern Railway. He was later transferred to the Goods Department at York, and subsequently held the post of Chief Clerk to the Continental Agent. In 1911 he acted as Personal Assistant to Sir Eric Geddes, at that time Deputy General Manager of the N.E.R. During the war Mr. Pearson was engaged on special duties for Sir A. Kaye Butterworth, General Manager, including the settlement of accounts arising out of the conveyance of troops and materials of the British and French armies serving on the Western Front. After the war Mr. Pearson became head of the staff and claims sections in the office of the Divisional General Manager, and returned to the Goods Department in 1932, as Assistant Manager.

Questions in Parliament

Rates for Transport of Iron

Mr. Jenkins on March 25 asked the Minister of Transport whether the rates now being charged by railway companies for the transport of iron billets, bars, and sections from Poplar Dock, London, to Birmingham and other Midland towns had been approved by the Railway Rates Tribunal.

Mr. Hore-Belisha.—I understand that none of the rates is more than 40 per cent. below the standard rate chargeable and that the consent of the Railway Rates Tribunal is not required.

Rateable Value of Railways

Mr. Gallacher on March 26 asked the Minister of Health whether he would give the total loss of rateable value and income from rates which local authorities would suffer if the recent decision of the House of Lords regarding the rateable value of the Southern Railway was carried into effect; which the affected authorities were, and what the respective losses would be in each case; what losses in the block grant under the Local Government Act, 1929, would be suffered by each of the authorities in question; and whether similar information was available for the local authorities receiving income from rates from the L.N.E.R., L.M.S.R., and G.W.R.

Sir Kingsley Wood.—The matter is still *sub judice*, and I think that until it is finally determined the substantial work which would be involved in arriving even at estimates of the figures asked for by the hon. member would not be justified.

Great Western Level Crossings

Mr. Wakefield on March 26 asked the Minister of Transport if he could state the number of level crossings on the G.W.R. which had been bridged or were about to be bridged under the terms of his 75 per cent. grant.

Mr. Hore-Belisha.—Six schemes (estimated to cost £250,000) for the elimination or avoidance of level crossings on the G.W.R. are included in the five year programme of road works which highway authorities have submitted. Four of these are scheduled for commencement within the next twelve months, subject to the completion of preliminary arrangements.

The Transport Advisory Council

Mr. Windsor on March 30 asked the Minister of Transport if he would state the terms of reference of the Transport Advisory Council, under the chairmanship of Lord Goschen, under which all means of transport were to be reviewed; and whether all representative interests would be taken into consideration.

Mr. Hore-Belisha.—The council has set up a committee of its members " to investigate the subject of service and rates in relation to goods traffic borne by rail, canal, road, and coastwise shipping." The present Chairman is the Rt. Hon. Sir Arthur Griffith-Boscawen.

Railway Benevolent Institution Annual Dinner

The Rt. Hon. Sir Robert Horne, G.B.E., K.C., M.P., Chairman of the Great Western Railway Company, presided on Tuesday at the seventy-eighth anniversary dinner of the Railway Benevolent Institution at the Connaught Rooms, Great Queen Street, W.C.2. This annual gathering of subscribers and friends of the institution affords an opportunity for enlisting the oratory of guests prominent in various walks of life to bring its work to the notice of an audience made receptive by excellent entertainment, and Tuesday's function fully maintained this agreeable and profitable tradition. Music was provided during dinner by Ernest Rutterford's band; Mr. Ceredig Jones (baritone) sang, and Mr. Fred Brezin, who describes himself as a "Continental pickpocket magician" justified his comprehensive title by demonstrating how the practice of magic may be applied to the transfer of property, and to other useful or entertaining activities. Dancing concluded the evening. The following list of donations and subscriptions was announced at the dinner:—

	£
Chairman's list:	
His late Majesty King George V (annual subscription)	100
Collected by the President	4,550
Collected by the chief officers and staff of the following companies:	
London Midland & Scottish Railway Sir Josiah C. Stamp, G.C.B., G.B.E., D.Sc.	2,407
Great Southern Railways Mr. P. J. Floyd	2,123
London & North Eastern Railway Sir Ralph L. Wedgwood, C.B., C.M.G.	1,538
Southern Railway Sir Herbert A. Walker, K.C.B. ...	771
Great Northern (Ireland) Railway Mr. J. B. Stephens	224
London Passenger Transport Board Mr. H. S. Chapman	217
Cheshire Lines Committee Mr. G. Leedam	186
Westinghouse Brake & Signal Co. Ltd. Mr. J. Griffith Hall...	142
Midland & Great Northern Railways Joint Committee Mr. R. B. Walker	81
Railway Signal Co. Ltd. Mr. W. S. Roberts	31
Other Collections	50
	£12,420

The following were among those present:—

Messrs. J. Abady, G. H. Loftus Allen, T. E. Argile, Major the Hon. J. J. Astor, M.P.

Messrs. W. E. Baines, E. Baker, Cecil Baillie-Gage, W. A. Ballard, Anthony Banks, H. Barade1, F. Stanto1 Barnes, Sir George L. Barstow; Mr. T. Barty, Capt. Guy V. Baxendale, Col. F. I. Beatley, Mr. A. P. Bevan, Comdr. W. T. Bird; Messrs. W. Bishop, S. A. Blackall, E. J. Bolton, H. Leslie Boyce, J. Bromley, C. J. Brown, J. S. Brown, Sir Henry P. Burt.

Sir John Ca1man, Hon. E. C. G. Cadogan; Messrs. L. J. A. Callaway, A. Campbell, R. Carpmael, C. Carslake, S. B. Carter, F. L. Castle, J. Cave, H. W. Chinn, Major W. H. Christy Clay; Col. H. F. Cobb, Mr. I. J. Trew Colquhoun, Sir Ralph Cope, Mr. C. H. Cowtan.

Messrs. C. R. Dashwood, R. G. Davidson, Ashton Davies, G. Cole Deacon, F. Deacon, W. J. Devenish, C. B. Dixon, Rt. Hon. the Earl of Dudley; Messrs. J. W. Dulanty, B. Dumas, A. Durrant, A. Eddy, C. W. Edwards.

Messrs. E. Falconer, P. J. Floyd, E. Fookes, Major G. Newton Ford; Mr. E. T. Forster, Dr. H. Caveadish Fuller; Messrs. H. H. Gardiner, J. F. Gee, E. Gore-Browne, K. W. C. Grand, R. S. Griffiths, I. S. W. Groom, M. C. Harrison, Sir Harold Hartley; Mr. C. A. F. Hastilow, Rt. Hon. Lord Hewart; Col. Frank Hilder; Messrs. F. J. Hills, C. W. C. Hine, C. Hodgson, G. B. Howden, A. Howie, S. Humbert, A. G. Hunt, E. E. Huskisson, Rt. Hon. Sir Thomas Inskip.

Sir Henry Jackson, M.P.; Messrs. T. W. Jacobs, W. A. Jepson, J. A. Kay, W. J. Kaye, J. D. Kennedy, R. Killin, J. King, A. E. Kirkus, C. H. S. Kirkus, J. W. A. Kislingbury, A. J. D. Kitson.

Messrs. D. R. Lamb, A. P. Lambert, W. E. C. Lazenby, L. J. Le Clair, G. Leedam, A. Lord, R. J. R. Loxdale, V. Loxdale.

Dr. Meta MacKenzie, Mr. W. G. P. Maclure, Dr. C. G. MacMahon; Rt. Hon. James MacMahon; Messrs. J. Marchbank, E. F. Marsh, G. Matthews, A. L. McColl, Sir Basil McFarland; Messrs. J. J. McDonald, J. McLaren; C. F. Minett, J. C. Mitchell, W. T. Monckton, K.C., Major C. H. Montgomery; Messrs. W. H. Morton, A. Moss, Lt.-Col. A. H. L. Mount; Rt. Hon. the Earl of Mount Edgcumbe.

Messrs. L. H. K. Neil, C. H. Newton, Sir Walter Nugent, Sir David J. Owen; Messrs. F. J. Orchin, E. E. Painter, Rt. Hon. Lord Palmer; Messrs. S. A. Parnwell, L. A. Pearson, J. G. Peirce, I. W. Phillips, Rt. Hon. Lord Plender; Mr. A. G. Pollard, Rt. Hon. Lord Portal; Messrs. F. R. Potter, M. A. Priestley, A. L. C. Purr, A. Quartermaine.

Rt. Hon. the Earl of Radnor; Messrs. R. M. T. Richards, C. A. Roberts, Trevor Roberts, W. S. Roberts, Sir Henry B. Robertson; Messrs. W. H. Robins, R. O. Rogers, A. P. Ross, S. G. Rowe, T. H. Rowe, T. W. Royle.

Messrs. C. J. Selway, C. Sheath, J. B. Stephens, J. N. Stephens, W. J. Stevens, Sir Charles Stuart-Williams; Mr. C. H. Sutherland.

Messrs. S. B. Taylor, E. Tennyson, C. H. Thompson, H. Thompson, H. L. Thorahill, W. S. Threadgold, G. F. Thurston, F. L. Timmins, F. W. Tipton, T. Syme Todd, W. J. Towner, G. Usher, S. G. Vowles.

Messrs. F. G. Wainwright, A. G. Walkden, Sir Herbert A. Walker; Major Ivor Walkinshaw; Mr. H. C. Walton, Major H. A. Watson; Lt.-Col. Sir William Wayland, M.P.; Messrs. W. C. Wayland-Carr, H. B. Webster, C. R. Wheeler, H. Wheeler, H. L. Wilkinson, N. Wilkinson, Alex. Wilson, H. C. Wintle, W. V. Wood, A. Woods, J. A. Worrall, C. A. Worsfold, Col. Sir W. Charles Wright.

The Rt. Hon. Lord Hewart, P.C., the Lord Chief Justice, proposed the toast of "Success to the Railway Benevolent Institution." There was, he said, no need for him to say what an honour it was to be entrusted with such a toast. As a mere lawyer, he found it no small satisfaction to observe how in all walks of life men's minds turned in moments of emergency to the legal profession. So had it been a little time ago when the Great Western Railway needed a new Chairman, and so was it now when the President of the institution had the difficult and delicate task of finding somebody to propose its health. From his study of past records he had found that all speakers during a large part of the last century had begun by expressing surprise at being selected to propose the toast. He himself felt no such astonishment. Sir Robert Horne had said to himself: "now here is a man with very little to do; I will find him something useful to do at any rate on one occasion." As a result, he had lately been much distracted in the course of his normal employment by wondering whether he knew any suitable stories connected with railways wherewith to leaven his speech.

The result of his researches was a series of humorous railway anecdotes covering many ages of railway travel in both hemispheres. "So much," Lord Hewart concluded, "for the great railway systems of the world, and now about your benevolent society. This institution, as I understand it, is a kind of earthly Providence. It helps those who help themselves, but it also helps those who through no fault of their own are not able to help themselves. I have the honour and pleasure of coupling this toast with the name of your President."

Sir Robert Horne, replying to the toast, thanked Lord Hewart for the eloquent terms and amusing illustrations of his speech. The institution was a cause in which they took the keenest interest and for which they felt the most ardent enthusiasm. Over three-quarters of a century they had distributed something like £3 million sterling for the relief of distress. No cause could have a more universal appeal, for it involved a great body of men in hourly and daily touch with the public. Their institution was called "benevolent," and, indeed, he considered the railways were the greatest philanthopists to be found in this country at the present time. Over the last four years or so some £300 millions of railway capital had earned no dividend or interest, which really meant that £300 millions of stockholders' savings had been working for the public with no recompense at all.

Whatever was asked for, the railways could provide it. If people wanted speed, they presented them with the Silver Jubilee. If they wanted luxury combined with the sensation of flying, all they had to do was to take a trip on the Cheltenham Flier. Those in search of the romantic and somewhat mysterious, of the airs and graces of a past age, could put themselves under the auspices of Sir Herbert Walker and take an electrified journey to Brighton. He had recently dreamed that he and Sir Herbert had presented themselves at the gates of Paradise, claiming admission thereto. It so happened that he had overheard the conversation of the inspecting officers, one of whom had taken exception to Sir Herbert on the grounds that he was advertising a Paradise of his own on the South Coast. In that case, he feared that members of the Great Western Company would have to endure a still more recondite punishment, because they had a much better Paradise on their own system than Sir Herbert. In conclusion, he had to express his deep gratitude to all who had supported the institution.

Mr. J. Bromley proposed the toast of "The President," and said it was 46 years since he had started on the G.W.R., and he felt he would be lacking in his duty if he did not say how proud he was of his long association with railways and railway officers. He had known Sir Robert Horne for a

long period, and he hoped Sir Robert would serve the Great Western Railway with the same distinction as he had done himself for over twenty years. He assured him that he would find the staff, particularly the locomotive staff, most courteous and anxious to assist, and he hoped he would live up to the great ideals of the company which he was now serving with such credit to both sides. He had been eight years with Sir Robert Horne in the House of Commons, and there had been nothing but cordiality between them. Now, in drinking this toast, they would link with it in their minds their congratulations to their President not only on his success in life, but for what he had achieved since becoming connected with the railway service.

Sir Robert Horne, in a brief reply to the toast, said he would like to mention the fact that the institution was indebted for a subscription amounting to £12,420, and wished to make special reference to the most generous contribution of £2,000 from Ireland. He had to welcome in particular Mr. Stephens, General Manager of the Great Northern Railway of Ireland, who was Chairman of the Management Committee of the institution's funds. For his skilful administration they could not express their gratitude too highly.

Railway Convalescent Homes Dinner

Mr. Robert Holland-Martin, C.B., Chairman of the Southern Railway Company, presided on Thursday of last week (March 26) at the spring dinner of the Railway Convalescent Homes, which was held in the Wharncliffe Rooms, Hotel Great Central. Among those present were:—

Sir Francis Joseph, Brigadier W. G. Lindsell, Messrs. J. S. Anderson, W. Bishop, John Bromley, R. Carpmael, H. S. Chapman, John Cliff, O. H. Corble, R. G. Davidson, J. Dewar, G. Ellson, Eric Gore-Browne, C. Grasemann, C. Jones, J. F. Lean, D. V. Levien, J. Marchbank, John C. Mitchell, W. G. Pape, Charles Sheath, and W. V. Wood.

Following the loyal toast and the interval, Mr. Holland-Martin presented a vellum of appreciation to Mr. F. G. Hunwick, late of the London Passenger Transport Board, who recently retired from the General Committee of the Railway Convalescent Homes.

The toast of "The Railway Convalescent Homes" was proposed by Mr. Eric Gore-Browne, D.S.O., Deputy-Chairman of the Southern Railway, who said it was pleasing to him to remember that the great enterprise of which he was proposing the toast, owed its origin to a Southern Railway man, or rather one who was associated with a constituent company of what was now the Southern Railway. The inception of the Railway Convalescent Homes movement was due to John Edward Nicholls of the L.C. & D.R. and his friends; it was pleasant to notice that one of these friends was present that evening, namely, Mr. W. Tyrrell. In the early days, after land for the first home had been secured at Herne Bay through the instrumentality of the great philanthropist, Mr. Passmore Edwards, money was needed to complete the building. Mr. Nicholls and his friends therefore went to their bankers, Glyn, Mills & Company, of which he (Mr. Gore-Browne) was a partner, and asked for a loan. With true banking caution they refused this unless some more tangible security was offered than the enthusiasm of the founders. Eventually a loan was arranged on the security of documents contained in a sealed envelope which was handed to Mr. Hardy, the Secretary of Glyn, Mills & Co. Exactly what that envelope contained was a mystery. It had been said to include the title deeds to the private houses of Mr. Nicholls and his friends, but there was also a rumour that the envelope held nothing more valuable than sheets of blank paper. He had consulted the records of the bank and found a note dated August 10, 1900, in Mr. Hardy's handwriting, which said "Loan of £2,000 against hypothecation of title deeds," but did not specify the precise security. Another note, dated November 16, 1900, recorded that on that day the deeds were surrendered to the Secretary of the Railway Convalescent Homes. This meant that, whatever was the truth regarding the loan security, the faith of the promoters was so amply justified that within three months they had raised enough to pay off the bank loan. That was characteristic of the movement, and the fact that today the homes had catered for the needs of 120,000 men, women, and children, exemplified the wonderful way in which voluntary work in the railway field succeeded. Each railway had its own peculiarities—they on the Southern Railway had their own eccentricity, namely, electrification—but, nevertheless, railwaymen were all one family working to a common end.

Coupling with the toast the name of their President, Mr. R. Holland-Martin, he said that he could imagine no more fitting chairman for the institution, particularly in view of his devotion to duty. As exemplifying this he would point out that Mr. Holland-Martin had a son riding in the Grand National tomorrow (namely March 27), and that at about the same time the race was being run Mr. Holland-Martin would be at Southampton welcoming the arrival of the *Queen Mary*. Actually he (the speaker) had arranged for a radio set to be available, so that Mr. Holland-Martin might have an opportunity of hearing the progress of his son, but if the events coincided and it was a choice between attending to duty by welcoming the *Queen Mary*, or listening in to the progress of the Grand National, there was no doubt which course their President would adopt.

In reply, Mr. Holland-Martin said it was appropriate that a toast proposed by a London banker should be replied to by another banker. Mr. Gore-Brown had as a sign above his bank an anchor —signifying hope—which was probably very appropriate. All banking signs were not so obvious, however. His (Mr. Holland-Martin's) bank, during the jubilee celebrations last year, exhibited its sign of a grasshopper, which Gresham had used when he was Queen Elizabeth's banker. Two workmen had noticed it, and the first opined it was a flea; the second thereupon said "I know bankers are called bloodsuckers, but I didn't know they were proud of it." Of the Railway Convalescent Homes Mr. Holland-Martin said they were run most economically and most sympathetically by railwaymen. The homes were not being increased in number at the present time, but were being improved in decoration and amenities. He noticed that the Southern Railway contributed the smallest percentage of subscribers to the Railway Convalescent Homes, and hoped it would be possible to alter this position.

The toast of "Our Guests" was proposed by Mr. G. H. Taylor, of the G.W.R., one of the Board of Trustees, who said the institution was believed to be the largest of its kind in the world. It owed a great deal to the sympathetic help of the railway companies in the form of the paybill deductions of contributions, free travel to and from the homes, and so forth, for which all concerned were very grateful.

Sir Francis Joseph replied. He said he also was a banker, and advised all those present to leave their deposits with him and their overdrafts with the previous speakers. The railway companies, he said, were at present in a dangerous state of convalescence, and, addressing himself particularly to Mr. Bromley, added "Please avoid giving us shocks." Mr. Charles Sheath also replied.

L.N.E.R. Carriage Servicing in Scotland.—The L.N.E.R. is providing additional carriage siding accommodation and cleaning and servicing equipment at the Craigentinny (Edinburgh), Cowlairs (Glasgow), and Craigendoran depots, where increased excursion and week-end travel has added considerably to the volume of traffic. The facilities at Craigendoran, where trains connect with the company's steamers to the Firth of Clyde resorts, will make it no longer necessary for stock to be run back to Cowlairs for cleaning and equipping in readiness for the return journey. Trains to Helensburgh will also use the depot, and the fact that the carriages will be quickly available when required will facilitate return arrangements from both places.

Improved Train Services in May and June

As is now customary on the London Midland & Scottish and London & North Eastern Railways, new timetables will come into operation on May 4, and will continue in use until the inauguration of the full summer service on July 6. One or two striking improvements in long-distance train running are to come into force in May, as set out hereunder.

London Midland & Scottish Railway

The down Midday Scot is to revert to its historic 2 p.m. departure time from Euston, instead of 1.30 p.m., but will pick up the entire 30 min. in running, so being 45 min. quicker on the throughout journey to Glasgow than in pre-war days. Crewe will be reached non-stop in 163 min. from London; the next stop will be Lancaster, as now, and an additional stop will be made at Penrith, though it is a little unfortunate that passengers for Keswick will be detained from 7.13 to 8.7 p.m. awaiting a connection. At Carlisle, reached at 7.35 p.m., the train will be divided, the Glasgow portion, leaving at 7.39 p.m., being non-stop in 116 min. The Midday Scot will thus provide the fastest service ever yet tabled from London to Glasgow, in 7 hr. 35 min. The Edinburgh and Aberdeen portions, leaving at 7.45 p.m., will re-divide at Lockerbie, whence the Edinburgh portion will run non-stop, arriving at 9.55 p.m. The Aberdeen portion will reach Perth at 11.28 p.m. instead of 12.10 a.m., as now—a gain of 42 min., due to its working with the Glasgow portion as far as Carlisle, instead of being detached, as now, at Crewe. This represents a total acceleration of 72 min. to Stirling and Perth. There will still be a 1.30 p.m. service from Euston, to Barrow, Whitehaven, and Windermere, reaching Preston at 5.31 instead of 6.5 p.m., Barrow at 7.11 instead of 7.51 p.m., and Windermere, without change, at 7.0 instead of 7.12 p.m. A contingent alteration is that the 5.0 p.m. from Manchester to Glasgow will start at 5.5 p.m., and call at Lancaster instead of Carnforth, with times unaltered from Oxenholme onwards. The down Royal Scot is to be accelerated by 10 min. south of Carlisle, and will at length revert to its pre-war 159 min. schedule from Crewe to Carlisle, reached at 3.34 p.m.; with no acceleration north of that point Glasgow will be reached at 5.45 p.m. and Edinburgh at 5.50 p.m. (both 10 min. earlier). In the up direction the Midday Scot is to be accelerated south of Carlisle by 5 min., and will now arrive at 9.20 p.m. (55 min. quicker than pre-war), with a booking of 164 min. from Crewe to Euston.

But the principal improvement in the south-bound direction is of the Ulster Express. Hitherto this train has left Heysham at 5.48 a.m., and has reached London at 11 a.m. The start is now to be delayed until 7 a.m., which will permit travellers to have a considerably more comfortable night on the steamer, but by an acceleration of 37 min., the train will be brought into Euston at 11.35 a.m., only 35 min. later. The Ulster Express will stop only at Crewe between Morecambe and London, giving a fast service from Crewe at 8.50 a.m., in 165 min. A restaurant car express will still run from Crewe to Euston at 7.46 a.m., in the previous Ulster Express times, save for an acceleration of 7 min. from Rugby to Euston, the 82·6 miles being scheduled in 82 min., at just over 60 m.p.h. from start-to-stop. Another accelerated up service is the Merseyside Express, to leave Liverpool (Lime Street) at 10.10 instead of 10 a.m., make the run of 189·7 miles from Mossley Hill to Euston in 189 min., and arrive at 1.30 p.m., as now, in 3 hr. 20 min. from Liverpool. The 10.30 a.m. from Euston to Manchester will be accelerated by 5 min. to Crewe (165 min.), reaching Manchester at 2.5 instead of 2.10 p.m. In Scotland, the 5.10 p.m. express from Glasgow to Stranraer, with the corresponding return express in the morning, is accelerated to make the run of 41·3 miles between Glasgow and Ayr in both directions in 45 min., at 55 m.p.h. start-to-stop.

London & North Eastern Railway

A long-felt want is to be met by the provision of an early morning service from King's Cross to the North-East Coast and Scotland. This will be effected by the extension to Edinburgh of the through coaches for York hitherto carried on the 7.25 a.m. Leeds express from King's Cross. A new restaurant car express is to leave York at 11.30 a.m., bridging over the great gap in morning northbound services which has hitherto existed from 10.5 a.m. to 12.50 p.m., calling at Darlington, Newcastle, Berwick, and Dunbar, and reaching Edinburgh at 3.50 p.m. Whereas for many years past it has been possible for the business man in Teesside or Tyneside to travel to London for business purposes, have 3½ to 4 hr. in town, and return the same day, and now still more expeditiously by the Silver Jubilee service, the reverse operation has not hitherto been within the reach of the London business man. It is to be hoped that this new facility may become so popular as to permit the provision of a considerably faster down morning service at a later date. Acceleration of the Queen of Scots Pullman will bring Leeds for the first time within 3 hr. 10 min. of King's Cross; leaving Edinburgh at 11.20 a.m. as now, this express will start from Leeds at 3.55 p.m., and reach King's Cross at 7.5 p.m. In order to keep clear, the 3.10 p.m. express from Leeds to London will be accelerated to a run of 3¾ hr., six stops included, and will reach King's Cross at 6.55 p.m.; similarly, to leave a better margin in front of the up Silver Jubilee, the 10.15 a.m. express from Leeds to London will leave at 10.10 a.m., and be due in London at 1.47 instead of 1.52 p.m. Now that the Hull section is once again being run independently, the 8.15 a.m. express from Newcastle to King's Cross will omit the Doncaster call, and revert to its 1.24 p.m. arrival in London; the Hull train will start at 9.10 instead of 9.25 a.m., and reach London at 1.15 instead of 1.24 p.m. In the down direction the Queen of Scots will reach Leeds at 2.31 p.m. (3 hr. 11 min.), and Edinburgh at 7.5 instead of 7.15 p.m. The down Flying Scotsman is also to be accelerated by 5 min., in order to reach Edinburgh at 5.40 p.m., both up and down Scotsmen thus taking 7 hr. 40 min. But no change is to take place in any of the continuation schedules between Edinburgh and Aberdeen. As regards local improvements, a new express is to run from Middlesbrough at 3.55 p.m. to York, non-stop from Thornaby, and reaching York at 4.57 p.m.; this will give a connection to the 5.10 p.m. from York to Manchester and Liverpool and to the 5.13 p.m. from York to King's Cross, arriving at 9.25 p.m. In the opposite direction a through Middlesbrough portion will run on the 10.5 a.m. from York, reaching Middlesbrough at 11.15 a.m.

Italian Railway Developments

Signor Antonio Benni, Italian Minister of Communications, when presenting to the Chamber of Deputies the estimates of the Ministry for the coming financial year, said that a new service of fast trains, running at 100 m.p.h., was to be inaugurated this year on the Italian main lines. These trains would be run not only on the electrified section between Bologna and Naples, but on lines not electrified, diesel-engined units being used for the latter.

Signor Benni stated that, after showing a deficit of £15,000,000 for the past year, the budget for the State Railways was now balanced. The balance had been effected principally by a rise in freight rates, reductions in personnel, transfer of a great proportion of railway pensions to the Ministry of Finance, and increased electrification. The railways now employed 134,000 men, compared with 241,000 in 1922.

To continue the policy of electrification and of eliminating purchases of coal from abroad, 438 miles of line were, he said, electrified in 1935, 144 miles would be electrified this year and 350 next year.

Railway Wages

The following announcement was made on March 28 jointly by the four main-line railway companies and the National Union of Railwaymen, the Associated Society of Locomotive Engineers and Firemen, and the Railway Clerks' Association:—

"Negotiations have been taking place for some time in regard to applications made by the trade unions for discontinuance of the percentage deductions from earnings, operating under the Agreement of August 10, 1934; and variation of certain conditions of service, as determined by National Wages Board Decision No. 119 of March 5, 1931. At a joint meeting held on March 25, it was agreed that consideration should be given to certain proposals which were discussed with a view to reaching a settlement. The Executive Committees of the three railway trade unions have since arranged for the proposals to be considered by their governing bodies where necessary.

"The proposals are as follow: That as from the first full pay following July 1, 1936, the deduction of 2½ per cent. from all earnings, at present operating under the agreement of August 10, 1934, shall be replaced by a deduction of 1½ per cent. from all earnings. Conditions of service as determined by National Wages Board Decision No. 119 to continue in force. These arrangements to operate for a period of twelve months and thereafter until varied by agreement or by decision of the Railway Staff National Tribunal.

"Similar proposals affecting railway shopmen have been under discussion by the National Railway Shopmen's Council."

It will be remembered that the position immediately prior to the agreement of August 10, 1934, was that all earnings of conciliation staff were subject to a deduction of 2½ per cent. with a further deduction of 2½ per cent. from earnings in excess of 40s. a week, but subject to the proviso that the earnings of men whose base rates were under 41s. a week were not reducible below their base rates and that in no case was the deduction to exceed 6s. a week. In the case of salaried staff the arrangement was a deduction of 2½ per cent. from all earnings with a further deduction of 2½ per cent. from earnings in excess of £100 per annum, provided that the total deduction was not to exceed £15 per annum. There were also modifications in the conditions of service, such as reduced rates of pay for overtime, Sunday, and night work. The total effect of all these reductions was to save the companies about £4,600,000 a year.

The effect of the agreement of August, 1934, was to reduce the percentage deductions from that portion of the earnings which exceeded 40s. a week (£100 per annum in the case of salaried staff) from 5 per cent. to 3¾ per cent. as from the beginning of October, 1934, and from 3¾ per cent. to 2½ per cent. as from the beginning of 1935. The full percentage deductions were not, however, to apply to those male adults whose base rates did not exceed 44s. a week and whose earnings were less than 44s. 6d. in a full week. For such men a lower scale of deductions was provided. Allowing for concessions to shop staff and other groups of staff similar to those agreed for the general body of railwaymen, the cost to the companies of the partial restoration of cuts agreed in 1934 was estimated at about £1,100,000 for a full year.

The following letter (dated March 28) from Mr. William Whitelaw, Chairman of the L.N.E.R., appeared in the *Glasgow Herald* of March 31:—

THE DEMANDS OF RAILWAY TRADE UNIONS

"I have read the announcement in your issue of today regarding the proposed settlement of the demands of the railway trade unions. As the announcement which has been officially supplied to you must necessarily cause great anxiety to a very large number of railway stockholders, I ask you to allow me to add some further information. The announcement indicates that the settlement has been proposed by the four main-line railway companies jointly; to say that it has been agreed to by three of the companies and imposed by a majority vote upon the fourth would be more accurate.

"The actual position is that on Tuesday last a special meeting of the Railway Association was held to receive a report from the general managers on the subject of salaries and wages. (The association is composed of the chairmen and deputy chairmen of the four companies, and any voting is by companies, not individuals.)

"At this meeting I, as representing the London & North-Eastern Company, opposed the policy of making a settlement by agreement and urged that the whole case should be referred to the National Wages Tribunal. I was alone among the chairmen in holding this view, and a decision to negotiate a settlement was arrived at by a majority of three to one. The main reason for favouring a reference to the National Wages Tribunal was that the original cut in wages and salaries, made by the former tribunal and accepted by the unions, was founded on the financial results of the year 1930, and that a comparison of the amounts available for dividend (Acct. No. 9), after deduction of the amounts brought in from the previous year, and any reserves used for dividend payments, in that year and in 1935 reveals that the companies were over £5,000,000 worse off in the latter year than in 1930, when the reductions were made and accepted. My colleagues of the London & North-Eastern Board are unanimous in believing that having regard to these facts no case can be established for an increase of salaries and wages at present; indeed, the figures suggest that a decrease is due.

"This is a decision which, in the view of my company, has been arrived at without due regard to the interests of the owners of the railways. The increased expenditure which will be incurred by this settlement, added to the increased cost of coal, which will have to be paid by the railway companies to assist in meeting the recent increase of wages to the miners, will go far to prevent anything like the full amount of the prospective decrease in payments of local rates, from which so much has recently been hoped, ever reaching the pockets of the stockholders."

G.W.R. (LONDON) MUSICAL SOCIETY CONCERT.—On March 27 members of the G.W.R. (London) Musical Society combined with the Swindon choir and orchestra to present their annual smoking concert at the Queen's Hall. In the principal item of the programme, a performance of Elgar's "The Banner of St. George," they were assisted by Miss Garda Hall (soprano) in the solo parts. In addition, during the evening Mr. Robert Easton (bass) and Mr. Walter Glynne (tenor), both of whom were enthusiastically received, rendered well-chosen items from their repertoire. In the second half of the programme the choir demonstrated its versatility in two part songs, "Sir Eglamose" and "London Town." Light entertainment was provided by Mr. Harry Brunning, whose impersonation of a well-known statesman was almost as much admired as is the gentleman himself in his own country, and by Miss Jeanne de Casalis, who extracted some heartily appreciated humour from two imaginary telephone conversations in her well-known characterisation of "Mrs. Feathers." As ever, the organisers of the concert had catered for all tastes, and, under the benign influence of their musical and other entertainment, the Queen's Hall shed what austerity it may hitherto have worn in the imaginations of the less musical members of the audience. Lord Palmer, the President of the society, was in the chair, a position he has occupied at these concerts without intermission since they were first transferred from the general meeting room at Paddington station to the Queen's Hall in 1920. Other officers present included Sir Ralph Cope, Mr. F. C. A. Coventry, Mr. J. Lean, and Mr. D. V. Levien.

MOSCOW UNDERGROUND EXTENSION.—A sum of 910,000,000 roubles has been voted for a further ten-mile extension of the Moscow Underground Railway. It is hoped that the work will be completed in 1937; the total length will then be about 17 miles, states a Reuters message.

RAILWAY AND OTHER MEETINGS

The British Automatic Co. Ltd.

The ordinary general meeting of the British Automatic Co. Ltd. was held at Winchester House, Old Broad Street, E.C., on March 27, Major R. D. Kingsdown Curling (Chairman and Managing Director) presiding.

The Secretary, Mr. W. A. Ballard, read the notice convening the meeting and the auditors' report.

The Chairman, in moving the adoption of the report and accounts, explained that the period covered therein was the fifteen months to December 31, 1935, the reasons for which change in the company's fiscal year had already been given. Referring to the balance sheet, he said that the increase of £10,629 under machines and fittings was accounted for by new machines, less value of machines scrapped. Freehold and leasehold premises, &c., were less by £611, due to additions of £839 less depreciation of £1,450. Investments in subsidiary companies were higher by £1,029. A new item on the balance sheet was cash deposited in respect of pension fund.

A very satisfactory feature was the decrease of £10,911, from £53,814 to £42,903, in sweetmeats and stores. Some of it was accounted for by the fact that the company required to carry smaller stocks in December than in September, but there had also been a strict control of stores, and of writing off those which had become obsolete. Cash on deposit and at bankers was £85,056, an increase of £25,948, and the total improvement in the company's financial position was roughly £60,000. The receipts of £47,797 from the settlement of the claim against Steel Industries had accounted for a large part of the improvement. A sum of £12,400 would be required for the 4 per cent. dividend.

Profits for the fifteen months were £37,444, and takings showed some improvement over those of the previous corresponding period. The conversion of the 8 per cent. debentures to 5½ per cent. had saved £3,072, and the full year's saving would be £6,125. After allocation to depreciation and renewals of £19,440, to contingency reserve of £1,878, and to writing down stock of £5,000, making a total of £26,015, the balance remaining was £19,440, out of which the directors proposed paying a dividend of 4 per cent., amounting to £12,400. There remained £7,040 to carry forward.

Continuing, the Chairman said that since the present board had taken over control of the company four years ago there had been no funds available for pensioning employees. The company had a large number of old servants, and in this connection he would like to refer to Mr. Peter Greenfield, Foreman of their Dublin works, who had retired after nearly 50 years. The board had made special grants in such cases, but this method was unsatisfactory, and they therefore considered it of paramount importance to establish a pension fund for employees. Such a move would do a great deal towards producing a contented staff, with the right sort of interest in their work. To provide pensions covering the past services of all employees, the company wanted a lump sum, and so it was not until a successful settlement had been achieved with Steel Industries that the money could be found.

The hope of improvement in trading had been realised, and in fact, results had been better than was anticipated. All branches of the company's activities had shown favourable returns. Relations with the railway companies continued to be satisfactory, and railway officers were most willing and helpful in all matters of mutual interest. The amusement business was expanding, and increased revenue was looked for from this source. It was, however, a highly competitive business, but the company had a capable staff in charge of this department. Weighing machines, of which the company had 13,000, continued to give satisfactory revenue, and as long as people took the trouble to look after their health, so long would the company reap the benefits from the earnings of its weighing machines.

Vending machines continued to give satisfactory returns, which the Chairman ascribed to the company's policy of giving good value. The quality of chocolates and sweets manufactured by the company itself had been improved, and the sale of its products (under the name of Reeves) had gone up. The Chairman hoped that, providing a settlement of the international situation was found, the receipts of the business would be maintained. They had an excellent and hard-working staff, whose one object in view was the increase of the company's trade each year.

After expressing his thanks to his colleagues on the board, the Chairman added that Major Montgomery, who had been with the company for six years, was retiring from the post of General Manager and had been co-opted to the board. Mr. F. L. Timmins had been appointed General Manager in his place, and Mr. W. A. Ballard had been promoted to Assistant General Manager. The adoption of the report and accounts was then proposed, and a dividend was declared of 4 per cent. actual, equal to 9s. 6d. per share, less income tax for the 15 months to December 31. The retiring directors, Lt.-Col. John Bigelow Dodge, D.S.O., and Major Charles Hubert Montgomery, M.I.Mech.E., A.M.I.E.E., were re-elected.

The report and accounts were unanimously adopted.

Associated Electrical Industries Limited

The annual general meeting of Associated Electrical Industries Limited was held at Bush House, Aldwych, London, W.C.2, on April 2, Sir Felix J. C. Pole (Chairman of the company) presiding.

In the absence of the Secretary (Mr. R. H. Haviland) through illness, the Comptroller (Mr. F. H. W. Cooke) read the notice convening the meeting and the auditors' report.

The Chairman, in moving the adoption of the report and accounts, said that at the meeting a year ago he had pointed out that the dividend of 6 per cent. was double the amount paid twelve months previously. This year the directors had the satisfaction of recommending a dividend of 8 per cent. after taking from the profits of the year the sum of £103,635, being the whole of the premium paid on redemption of mortgage debenture stock last July. The amount to be carried forward to the next account was also substantially greater.

The total capital remained the same as last year, but the 4 per cent. debentures and accrued interest, which amounted in total to £1,057,080, no longer appeared. Cash and Government securities stood at £637,157, a decrease of £678,881, due to the necessity of providing funds for the redemption of debentures.

The profit and loss account showed a decrease of £20,299 in debenture interest, representing the saving in this item since the redemption of the debentures in July. Depreciation, £91,832, showed an increase of £1,393 as compared with last year; this referred only to the assets of the Metropolitan-Vickers Electrical Company. The total amount of depreciation provided in 1935 by all the companies in the Associated group was £349,593. During the past five years the Metropolitan-Vickers Electrical Company alone put to depreciation of plant a total of £420,000, or an average of £84,000 a year. The British Thomson-Houston Company's figure was even larger. Many years' experience in the engineering industry had shown the directors that substantial depreciation of plant from year to year was essential. Income Tax provision was increased by £49,922. Profit during the year, including dividends from subsidiary companies, which dividends in the aggregate, after providing for contingencies, were less than the profits earned as shown by the accounts of the

respective companies, amounted to £828,519, an increase of £241,637. After deducting interest on debentures to the date of redemption, £21,155; depreciation £91,832; and Income Tax £179,674, there was a balance of £535,858, to which had been added £113,336 brought forward from the previous year, making the total profit available for distribution £649,194. Deducting dividends on preference stock and the premium on redemption of the 4 per cent. debentures, there remained a balance of £469,110. Out of this the directors recommended payment of a dividend on the ordinary stock at the rate of 8 per cent. per annum less income tax, leaving a balance to be carried forward of £165,405, an increase of £52,069.

The total capital and debentures as shown by the consolidated balance sheet amounted to £7,677,020. Creditors, loans and accrued charges had increased £924,078 and general reserves and profit and loss account, after providing for dividends, had increased £199,923. On the assets side, stock and work in progress had increased £503,523. Debtors, loans, and payments in advance had increased £256,882, but—due principally to the redemption of the debentures—British and Dominion Government securities and cash in hand decreased £662,538, and now stood at £1,391,064.

Output at all the company's works was maintained at a high level, and the volume of orders received was satisfactory, compared with previous years. Orders in hand on December 31, 1935, were on a higher level than at the end of 1934. For the first three months of this year, orders received were materially greater than in the first quarter of last year. In the case of the Metropolitan Vickers Electrical Company, the orders received last year were the second largest in the company's history. From the point of view of money value the record year was 1920, but at that time prices were much higher than they were today, and there was no doubt that the amount of work actually turned out last year constituted a record.

Notable work completed during the year included a 105,000 kW. turbo-alternator set for the Battersea station of the London Power Company, the largest ever made in this country; the 24,000 kW. turbine for the Thermo-technical Institute, Russia, was installed and was operating satisfactorily. Two 75,000 kVA. transformers were completed for the Fulham station of the Fulham Corporation. These units were among the largest in the world. The largest order received was the contract from the Brazilian Government for the electrification of a portion of the Central Railway of Brazil in and around Rio. From the South African Government the company had an order for 25 electric locomotives for the Natal railway extensions. These locomotives were generally similar to 95 previously supplied to the South African Government. The Victoria Falls and Transvaal Power Company ordered two additional 33,000 kW. turbo-alternator sets. Orders secured in the home market included one from the North Metropolitan Electric Light & Power Company for a 20,000-kW. high-pressure turbo-alternator set, and a 30,000-kW. low-pressure set. Important orders had been received from the London Passenger Transport Board for trolleybus equipments, and this form of transport was expanding. In regard to electric traction, special reference should be made to the system of regenerative control known as the Metadyne, which had been developed by the Metropolitan-Vickers Electrical Company. This development must have an important influence on railway electrification schemes, several of which were about to be undertaken by the main line railways, as well as by the London Passenger Transport Board. Overseas business had improved, especially in South Africa, whilst there was also an increase of activity in Australia, India and New Zealand.

In addition to making the largest apparatus, such as turbo-alternator sets, electric winders for mines, electrically operated rolling mills for steel plants, transformers, switchgear, &c., the companies of the group also made many varieties of electrical devices, including motors, welding equipments and electrodes. The lamp business of their companies continued to expand, and three out of four lamps installed in the *Queen Mary* were supplied by companies of the Associated Electrical group.

The advance in engineering knowledge and the growing complexity of systems for the generation and distribution of electricity gave rise to more exacting technical requirements, and made heavy demands on the engineering staffs. Their engineers and designers were supported by a very efficient research department at the Trafford Park works. In this connection he could not do better than repeat the words of Mr. Lusk at the recent meeting of the British Thomson-Houston Company, who said: "research work continues to be actively carried on, both original research with the object of finding new products and processes which may be useful in the industry, and research in connection with our existing products of all sorts, from the largest turbo-alternator sets to the smallest electric lamps, whose efficiency and other characteristics we are constantly striving to improve. It is only in this way that we are able to maintain our position as a leader in the electrical manufacturing industry."

The Chairman was glad to say that employment in the factories of the group continued to be on a substantially higher level than in recent years. At the end of the year they had, in round figures, 33,000 employees, and it was a great pleasure to record that the most friendly relations existed with employees of all grades.

The General Electric Company of America had, through its subsidiary, the International General Electric Company, a considerable financial interest in the associated companies, and it was its intention to continue to hold a substantial but minority interest. During last year, the G.E.C. sold a large block of its holding and a substantial majority of the Stock was now held in this country. There had been a gratifying increase in the number of stockholders. As compared with last year, some 3,000 more people were now interested in the welfare of A.E.I.

The Chairman then moved: "That the report of the directors dated March 24, 1936, together with the balance sheet as at December 31, 1935, be and they are hereby adopted, and that a dividend of eight per cent., less income tax, be declared and be paid on April 7, 1936, to the holders of ordinary stock of the company registered in the books of the company on March 19, 1936."

The report and accounts were unanimously adopted.

Railway and Other Reports

Trent Motor Traction Co. Ltd.—Total revenue for 1935 of this company, which is controlled jointly by the L.M.S.R. and L.N.E.R. companies and Tilling & British Automobile Traction Limited, amounted to £457,012, against £406,700 for 1934. The profit, after deducting expenses, depreciation, &c., is £46,666, against £41,057. Reserve again takes £20,000, the dividend remains the same at 10 per cent., and the amount to be carried forward is £10,541, against £10,675 brought in. Expenditure on capital account has been £213,881, mainly for purchase of local omnibus businesses and cost of new omnibuses. Since the close of the year 107,200 new shares of £1 have been issued at par, ranking for dividend as from January 1, 1936.

Associated Electrical Industries Limited—The profit for the year 1935, after deduction of all expenses and charges other than debenture interest, depreciation and income tax, is £828,519, an increase of £241,637 on 1934. Debenture interest takes £21,155, depreciation £91,832, and income tax £179,674, leaving a balance of £535,858. Adding £113,336 brought forward makes a total profit available for distribution of £649,194. Dividends for the year on the 8 per cent. preference stock take £76,449, and the sum of £103,635 goes to premium on redemption, July, 1935, of the 4 per cent. mortgage debenture stock, leaving a balance of £469,110. The directors propose a dividend of 8 per cent. (less tax) on the ordinary stock, leaving £165,405 to be carried forward. The dividend for 1934 was 6 per cent. All the company's works were well employed during the year, and the orders in hand at December 31 were on a higher level than at the end of 1934. During the year the whole of the £1,036,353 4 per cent. mortgage debenture stock was redeemed, the sum required being found out of liquid resources.

NOTES AND NEWS

N.S.W. Power Signalling.—The Railway Commissioner for New South Wales is reported by *The Electrical Review* to have stated that power signalling is to be installed throughout the N.S.W. Government Railways system.

Diesel Railcar Tried on Chesham Branch.—On Friday, March 20, a streamlined diesel railcar was tried on the Chesham branch, Met. & G.C. Joint Committee, a suitable opportunity having arisen through the Associated Equipment Company having completed a car for the G.W.R. two or three weeks before it was actually required for service.

Abolition of First Class on Further London Lines.—On and after May 4 first class carriages will be abolished on the Hammersmith and City and Addison Road branches of the Metropolitan Line, and on the East London Line. Of the railways owned or worked by the London Passenger Transport Board, this leaves only the District and part of the Metropolitan Line with first class carriages.

Indian State Railways Dinner.—The annual dinner of the Indian State Railways will be held at the Café Monico, Shaftesbury Avenue, London, on Monday, May 25. Dinner tickets, price 12s. 6d., can be obtained from Grindlay & Co., 54, Parliament Street, Whitehall, London, S.W. Further particulars can be had from the Honorary Secretary, Mr. H. B. Holmes, "La Villa," Victoria Crescent, St. Helier, Jersey.

The "Autocarrier" Back in Service.—On Wednesday last, April 1, the Southern Railway *Autocarrier* service between Dover and Calais was resumed. This vessel, built specially for the conveyance of motorists travelling with their cars, leaves Dover Marine station daily at 11.0 a.m. and Calais (Paul Devot quay) at 2.0 p.m. The transit time is 1½ hr. The rates for the conveyance of cars range from 45s. 6d., according to wheelbase; a special cheap single fare of 12s. 6d. is charged for passengers, with or without cars.

Road Accidents.—The Ministry of Transport return for the week ended March 28 of persons killed or injured in road accidents is as follows. The corresponding period of last year:—

	Killed, including deaths resulting from previous accidents		Injured	
England ...	83	(85)	3,374	(2,724)
Wales ...	2	(6)	146	(121)
Scotland ...	5	(9)	317	(300)
	90	(100)	3,837	(3,145)

The total fatalities for the previous week were 108, as compared with 100 for the corresponding period of last year.

Swiss Railway Reorganisation Bill.—A message from Bern states that a Bill to establish a less rigid system of administration and finance for the Federal Railways has been introduced in Parliament and is due for adoption before the end of the year. The Bill also proposes that wages should in future be fixed by Government decree and not by Federal law, that the State should take over Fr. 1,200,000,000 worth of debt, and that this should be amortised in 60 years. The principle of State ownership remains unaltered.

M. & G.N.J.R. Ambulance Team Successes.—The South Lynn ambulance team which, as recorded in last week's issue, recently won the M. & G.N. Ambulance Challenge cup, secured first place in the preliminary round of the inter-railway competition held in London on March 27, and therefore qualified to compete in the final Inter-Railway Ambulance competition to be held in London in May next.

Further G.W.R. Diesel Railcar Services.—Beginning on Monday next, April 6, seven additional G.W.R. passenger services will be provided daily by the new A.E.C. streamlined diesel railcar No. 15 in the Cheltenham, Stroud, Swindon, and Marlborough area where they will afford connections with other main-line services. In the Birmingham, Stratford-on-Avon, and Hatton area, four additional services, worked by existing railcars, will be provided as from April 13, bringing the total number of services now operated by streamlined diesel railcars up to 132 daily.

New Train Service to Barking Line.—On Monday last, March 30, the London Passenger Transport Board ran the first through train from the northern part of the Inner Circle to the Barking Line. A full rush-hour service from Hammersmith to Barking will begin on May 4, but until then one through experimental train will be run in the morning and one in the evening between Hammersmith and East Ham. The experimental train is composed of Hammersmith and City rolling stock, distinguished by large yellow panels giving details of destination and route. On May 4, the service will be implemented by new District Line stock now being delivered.

Southern Railway Bill.—This Bill came on March 31 before a Select Committee of the House of Commons. The Isle of Wight County Council asked that the proposal to sell to the Isle of Wight Ferry Boat Co. Ltd. the vessels and land employed by the railway company in connection with the service between Lymington and Yarmouth (I.W.) should not be sanctioned unless the railway company was placed under a statutory obligation to provide for the service in the event of the ferry company desiring to discontinue it. Sir Herbert Walker, General Manager of the Southern Railway, explained that his company had suffered considerable losses for a number of years on the Lymington service. There were two other routes to the Isle of Wight, from Southampton to Cowes, and from Portsmouth to Ryde, and the journey from London to the coast would be much improved by the Portsmouth electrification. The ferry company would also provide a quicker service from Lymington. The Committee sanctioned the railway company's proposals unconditionally.

Withdrawal of Quainton Road to Verney Junction Passenger Service.—The Metropolitan and G.C. Joint Railway Committee announces that on and from July 6 the passenger train service between Quainton Road and Verney Junction will be withdrawn, and Granborough Road and Winslow Road stations will be closed to all traffic. At the same time, Waddesdon station, on the main line, will also be closed to all traffic. The line between Quainton Road and Verney Junction will continue to be used for the exchange of goods and perishable traffic between the Metropolitan and G.C. Joint Committee and the L.M.S.R.

London Transport Bills.—Evidence was continued on March 26 before the Select Committee of the House of Commons which has been considering the tube extension and electrification proposals forming part of the £42,000,000 London Transport improvement scheme and contained in Bills promoted respectively by the L.P.T.B., L.N.E.R., and G.W.R. Mr. David Anderson and Sir Harley Dalrymple Hay explained the proposals from the engineering side, and Sir Ralph Wedgwood and Sir James Milne also gave evidence. Major Matheson, of the Ministry of Transport, who attended at the request of the Committee on March 27, referred to five level crossings on the Leyton-Loughton line and to a low narrow bridge at Snaresbrook. The Committee, on March 27, approved the railway proposals, subject to the condition that bridges should be substituted for these level crossings, and that the bridge at Snaresbrook should be improved. It is understood that 75 per cent. of the cost of these works will be provided by the Ministry of Transport.

Industrial Transport Association Luncheon.—Some fruitful lines of enquiry were suggested to members of the Industrial Transport Association by speakers at a luncheon held on Wednesday at St. Ermin's Restaurant, Caxton Street, S.W.1, under the chairmanship of Sir Patrick J. Hannon. Sir Francis Joseph (a Director of the L.M.S.R.) asked whether it would not be possible by public expenditure to bring the canals of this country up to date, and so give some relief to the congested state of the roads. Another problem was that of wagon capacity. Small coal merchants at wayside stations did not want more than 10-ton loads, and were embarrassed not only by the demurrage on 20-ton wagons, but by the difficulty of handling and unloading them. Sir Cyril Harcomb

(President of the Institute of Transport) also dealt with the wagon problem, and suggested that the system of privately-owned coal wagons was not really economic in view of the labour involved in sorting them out and returning them to their respective collieries. Dealing with road transport, he said he was struck by the extent to which the industry was in the hands of the small haulier. Holders of A licences owned an average of 3½ vehicles each, B licence holders an average of 1½, and holders of C licences an average of 2.

L.N.E.R. Musical Society's Concert.—At the concert in the Hamilton Hall on Friday, March 27, the chair was taken by Mrs. L. H. K. Neil, wife of the Assistant Continental Traffic Manager, L.N.E.R. Among those present were :—

Mr. Wm. Whitelaw, Sir Chas A. Batho, Messrs. O. H. Corble, P. J. Dowsett, E. L. Hawkins, W. H. Hyde, Col. H. H. Mauldin, Messrs. L. H. K. Neil, C. H. Newton, M. D. Robinson, and Percy Syder.

The music was provided by the society's full symphony orchestra and the London section of the male voice choir, with Miss Freda Townson, contralto, Miss Marie Wilson, solo violin, and Mr. Victor Harding, baritone. The concert was conducted by Mr. Leslie Woodgate. A noteworthy feature of the programme was the "Ballad and Polonaise" of Vieuxtemps (Opus 38), which was played by Miss Marie Wilson accompanied by the orchestra.

L.M.S.R. Amateur Boxing Tournament.—On March 14 the L.M.S.R. Manchester Goods District held a successful goods tournament at the King's Hall, Belle Vue, Manchester, on March 14. The object of the event was to raise funds for the Railway Servants' Orphanage, Derby, and it was promoted by Mr. H. G. Humphreys, the Manchester District Goods Manager. The attendance numbered between four and five thousand, so that a substantial sum was handed over to the orphanage. Mr. Humphreys offered a silver cup to the station team with the highest number of points, and this was won by Oldham Road goods station, members of which were winners in three of the eight competitions.

British and Irish Traffic Returns

GREAT BRITAIN	Totals for 13th Week			Totals to Date		
	1936	1935	Inc. or Dec.	1936	1935	Inc. or Dec.
L.M.S.R. (6,917 mls.)	£	£	£	£	£	£
Passenger-train traffic...	419,000	416,000	+ 3,000	4,842,000	4,804,000	+ 38,000
Merchandise, &c. ...	488,000	468,000	+ 20,000	6,010,000	5,790,000	+ 220,000
Coal and coke ...	237,000	234,000	+ 3,000	3,614,000	3,443,000	+ 171,000
Goods-train traffic ...	725,000	702,000	+ 23,000	9,624,000	9,233,000	+ 391,000
Total receipts	1,144,000	1,118,000	+ 26,000	14,466,000	14,037,000	+ 429,000
L.N.E.R. (6,333 mls.)						
Passenger-train traffic...	267,000	263,000	+ 4,000	3,233,000	3,222,000	+ 11,000
Merchandise, &c. ...	354,000	339,000	+ 15,000	4,186,000	4,058,000	+ 128,000
Coal and coke ...	231,000	236,000	− 5,000	3,342,000	3,174,000	+ 168,000
Goods-train traffic ...	585,000	575,000	+ 10,000	7,528,000	7,232,000	+ 296,000
Total receipts	852,000	838,000	+ 14,000	10,761,000	10,454,000	+ 307,000
G.W.R. (3,746½ mls.)						
Passenger-train traffic...	166,000	163,000	+ 3,000	2,020,000	2,006,000	+ 14,000
Merchandise, &c. ...	199,000	190,000	+ 9,000	2,395,000	2,324,000	+ 71,000
Coal and coke ...	101,000	104,000	− 3,000	1,464,000	1,410,000	+ 54,000
Goods-train traffic ...	300,000	294,000	+ 6,000	3,859,000	3,734,000	+ 125,000
Total receipts	466,000	457,000	+ 9,000	5,879,000	5,740,000	+ 139,000
S.R. (2,154 mls.)						
Passenger-train traffic...	256,000	255,000	+ 1,000	3,118,000	3,064,000	+ 54,000
Merchandise, &c. ...	65,500	72,500	− 7,000	751,000	773,000	− 22,000
Coal and coke ...	34,500	36,500	− 2,000	486,000	455,000	+ 31,000
Goods-train traffic ...	100,000	109,000	− 9,000	1,237,000	1,228,000	+ 9,000
Total receipts	356,000	364,000	− 8,000	4,355,000	4,292,000	+ 63,000
Liverpool Overhead ... (6½ mls.)	1,092	1,060	+ 32	14,484	14,134	+ 350
Mersey (4½ mls.) ...	4,188	4,135	+ 53	53,985	52,949	+ 1,036
*London Passenger Transport Board ...	556,300	537,600	+ 18,700	21,166,800	20,767,600	+ 399,200
IRELAND						
Belfast & C.D. pass. (80 mls.)	1,671	1,623	+ 48	21,944	22,066	− 122
,, ,, goods	656	495	+ 161	6,635	6,073	+ 562
,, ,, total	2,327	2,118	+ 209	28,579	28,139	+ 440
†Great Northern pass. (543 mls.)	7,200	7,100	+ 100	93,200	90,800	+ 2,400
,, ,, goods	11,600	10,600	+ 1,000	116,450	110,750	+ 5,700
,, ,, total	18,800	17,700	+ 1,100	209,650	201,550	+ 8,100
†Great Southern pass. (2,076 mls.)	26,104	26,911	− 807	320,966	312,179	+ 8,787
,, ,, goods	46,784	44,284	+ 2,500	499,384	475,851	+ 23,533
,, ,, total	72,888	71,195	+ 1,693	820,350	788,030	+ 32,320

* 39th week, the receipts for which include those undertakings not absorbed by the L.P.T.B. in the corresponding period last year; last year's figures are, however, adjusted for comparative purposes
† 12th week.

British and Irish Railways Stocks and Shares

Stocks	Highest 1935	Lowest 1935	Prices April 1, 1936	Rise/Fall
G.W.R.				
Cons. Ord. ...	55½	44½	48	+½
5% Con. Prefce. ...	124	108	119½	—
5% Red.Pref.(1950)	117	106¾	108½	—
4% Deb.	118½	108	114½	—
4¼% Deb. ...	122	110	117½	—
4½% Deb. ...	129½	118	127½	—
5% Deb.	140¼	130	140½	—
2½% Deb.... ...	82¼	68½	77	—
5% Rt. Charge ...	137	128	134½	—
5% Cons. Guar. ...	136¾	120½	130½	+1
L.M.S.R.				
Ord.	25 5/16	16	23	+1
4% Prefce. (1923)	58¼	43½	67½	+1½
4% Prefce. ...	87½	73½	85½	+2
5% Red.Pref.(1955)	107	97¾	105½	—
4% Deb.	110¼	99½	109	—
5% Red.Deb.(1952)	119 11/16	115 5/16	118½	—
4% Guar.... ...	105⅝	95½	104½	+1
L.N.E.R.				
5% Pref. Ord. ...	15⅞	8¼	10	—
Def. Ord.	7 9/16	4¾	5½	—
4% First Prefce....	74¾	48	64½	+1
4% Second Prefce.	31⅝	16¼	24½	+½
5% Red.Pref.(1955)	92¼	71	90½	—
4% First Guar. ...	103 11/16	93	101½	+½
4% Second Guar.	98¾	82½	93½	+1
3% Deb.	86	75	81½	—
4% Deb.	109¼	98½	107½	—
5% Red.Deb.(1947)	118½	106½	112½	—
4½% Sinking Fund Red. Deb.	112½	108	109½	—
SOUTHERN				
Pref. Ord.... ...	87½	69⅜	94	+2
Def. Ord. ...	25 15/16	16¾	24	+1
5% Prefce. ...	124	108¼	120½	+1
5% Red.Pref.(1964)	117¾	109½	118½	—
5% Guar. Prefce.	136½	121½	131½	—
5% Red.Guar.Pref. (1957)	121¼	112½	117½	+1
4% Deb.	116¾	107	113½	—
5% Deb.	138	130¼	138½	—
4% Red. Deb. 1962–67	115	106½	115½	—
BELFAST & C.D.				
Ord.	9	4	9	—
FORTH BRIDGE				
4% Deb.	111¼	104½	104½	—
4% Guar.... ...	109⅞	104	104½	—
G. NORTHERN (IRELAND)				
Ord.	20	7	15	—
G. SOUTHERN (IRELAND)				
Ord.	57½	14½	45½	—
Prefce.	50	25¼	56	+3
Guar.	88¾	51¼	84¾	+1¾
Deb.	86¼	70	89¼	+1½
L.P.T.B.				
4½% "A" ...	130	119¾	124½	—
5% "A" ...	139¾	130	134½	—
4½% "T.F.A." ...	113¾	108	110	—
5% "B"	131½	122¾	127	—
"C"	109½	91	105	—
MERSEY				
Ord.	23⅛	9¼	26½	—
4% Perp. Deb. ...	100½	93½	97½	—
3% Perp. Deb. ...	75½	67	76	—
3% Perp. Prefce.	62	47¼	64½	—

CONTRACTS AND TENDERS

L.N.E.R. Wagon Orders

The L.N.E.R. has placed orders for 500 four-wheeled bolster wagons, to be divided between Charles Roberts & Co. Ltd., and Hurst Nelson & Co. Ltd.

The Birmingham Railway Carriage & Wagon Co. Ltd. has received an order from the Crown Agents for the Colonies for three bogie goods brake vans for the 3 ft. 6 in. gauge, Gold Coast Government Railways.

Steel Rail Orders

The South African Railways & Harbours Administration has placed orders for approximately 27,000 tons of 96 lb. rails, all to be controlled-cooled by the Sandberg oven process, as follow :—

Barrow Hæmatite Steel Co. Ltd.	7,000 tons.
Lancashire Steel Corporation Limited	3,099 ,,
United Steel Cos. Ltd., Workington Iron & Steel Branch	3,421 ,,
Guest Keen Baldwins Iron & Steel Co. Ltd.	10,000 ,,
Colvilles Limited	3,527 ,,

The South African Railways & Harbours Administration has also placed an order for 3,000 tons of Sandberg regulated sorbitic oven-cooled rails with the Workington Iron and Steel Branch of the United Steel Cos. Ltd.

The Egyptian State Railways Administration has placed orders for 984 tons of rails with Colvilles Limited and 1,600 tons with the Lancashire Steel Corporation Limited, all to be controlled cooled by the Sandberg oven process.

The Rhodesia Railways Administration has placed orders for 20,000 tons of rails, all to be controlled-cooled by the Sandberg oven process, with the Cargo Fleet Iron Co. Ltd. and Dorman Long & Co. Ltd.

The New Zealand Government Railways Administration has placed an order for 5,874 tons of rails, to be controlled-cooled by the Sandberg oven process, with Guest Keen Baldwins Iron & Steel Co. Ltd.

The Chinese Government Purchasing Commission has placed the following orders, for equipment required for the Canton-Hankow Railway, to be supplied to the inspection of Messrs. Fox & Mayo :—

Reynolds & Wilson Limited, Heavy duty lathe.

Ratner Safe Co. Ltd., Safes.

Waterlow & Sons, Ticket date perforating machines.

The Bengal-Nagpur Railway Administration has placed the following orders :

H. W. Ward & Co. Ltd., Combination turret lathe.

Fielding & Platt Limited, Hydraulic pipe bending machine.

Howell & Co. Ltd., 200 Superheater flue tubes, Aquacidox quality.

Thos. Firth & John Brown Limited, Supply of tups for pneumatic hammers.

E. G. Herbert Limited, File testing machine.

William Denny & Brothers Limited, of Dumbarton, has received an order from the L.M.S.R. for a twin-screw motor vessel, 94 ft. long, to run between Ardrossan and Arran. The vessel is to be used for the carriage of mails, goods, and a limited number of passengers.

The Allied National Corporation has received an order from the Siamese State Railways, to the inspection of Messrs. Sandberg, for 100,000 fishbolts and nuts to be manufactured by Foulart Freres.

The Hunslet Engine Co. Ltd. has received an order from the Crown Agents for the Colonies for one locomotive boiler required for the British Guiana Railway.

The United Steel Co. Ltd., Workington Iron and Steel Branch, has received an order from the Southern Railway for 12,600 tons of Sandbag Regulated Sorbitic Oven-cooled rails.

Hurst, Nelson & Co. Ltd. has received an order from the Jodhpur Railway, to the inspection of Messrs. Rendel, Palmer & Tritton for six bogie carriage underframes, complete with wheels and axles and vacuum brake gear.

The South Indian Railway Administration has placed orders with the Steel Company of Scotland Limited for 60 locomotive tyres and with the Blaenavon Company for 120 carriage and wagon tyres.

Leyland Motors Limited has received the following orders from railway and railway associated road transport operators :—

South African Railway & Harbours Administration, two Terriers.

W. Alexander & Sons Ltd., 100 oil-engined Tigers.

The Finnish Government Railways Administration, it is reported, has signed a five-year contract with O. T. Vuoksenniska A.B., of Vuoksenniska, for the annual delivery of 8,000 tons of rails. This will result in half the annual requirements of Finland being supplied from home sources.

Forthcoming Events

Apr. 3 (*Fri.*).—Electrical Industries Benevolent Association, at Savoy Hotel, Strand, London, W.C.2. Annual General Meeting and Luncheon.

Institute of Transport (Birmingham Graduate), at Imperial Hotel, 6.30 p.m. Annual General Meeting.

Institute of Transport (Leeds), at Town Hall, 6.30 p.m. "British Shipping to the Far East," by Mr. F. Grosvenor.

Institute of Transport (London), at Connaught Rooms, Great Queen Street, W.C.2, 6.30 for 7 p.m. Annual Dinner.

Institute of Transport (Nottingham Graduate), at Guildhall, 7 p.m. Annual General Meeting.

Institution of Mechanical Engineers, Storey's Gate, London, S.W.1, 7 p.m. Informal Meeting.

Apr. 6 (*Mon.*).—Hull Traffic Association (Grimsby), at Chamber of Commerce, Victoria Street, 7.30 p.m. "Transportation," by Mr. F. Allitt.

Institute of Transport (London), at Inst. of Electrical Engineers, Savoy Place, W.C.2, 5.30 p.m. "The Problem of Railway Charges," by Mr. W. Wood.

Stephenson Locomotive Society (London), at L.N.E.R. Dining Club, King's Cross Station, 6.30 p.m. Photographic Exhibition.

Apr. 7 (*Tues.*).—Industrial Transport Association, at British Iron and Steel Federation, Caxton House, Tothill Street, London, S.W.1, 6.30 p.m. "London Passenger Transport Board Organisation," by Mr. J. Mackinnon.

Institution of Civil Engineers, Great George Street, London, S.W.1, 6 p.m. "Corrosion of Iron and Steel," by Sir Robert Hadfield, Bart.

Apr. 8 (*Wed.*).—Institution of Railway Signal Engineers, at Hunt's Bank, Manchester. "Some Notes on Electric Interlocking," by Mr. W. Webb.

L.N.E.R. (Cambridge) Lecture and Debating Society, at Railway Social Club, 7 p.m. "Renewal of Bridges," by Mr. B. Fletcher.

Permanent Way Institution (Leeds), at Quebec House, Quebec Street, 7.30 p.m. "Invention and Railway Development," by Mr. W. A. Willox.

Permanent Way Institution (London), at L.M.S.R. Dining Club, Cardington Street, N.W.1, 7 p.m. "Rail Joints," by Mr. W. White.

Apr. 9 (*Thurs.*).—Institute of Metals (London), at Society of Motor Manufacturers, 83, Pall Mall, S.W.1, 7.30 p.m. Annual General Meeting.

Institution of Engineering Inspection, at British Industries House Club, Marble Arch, London, W.1, 5.30 for 6 p.m. "The Inspection and Testing of Power and Automatic Railway Signalling and Point Operating Installation," by Mr. D. Shipp.

Apr. 10 (*Fri.*).—Railway Students' Association (Edinburgh), 7.30 p.m. Annual General Meeting.

Apr. 14 (*Tues.*).—Permanent Way Institution (Manchester-Liverpool), at Temperance Inst., London Street, Southport, 3 p.m. "Improvement of Permanent Way Connections during Relaying (2)," by Mr. A. Dickinson.

Permanent Way Institution (Sheffield), at Royal Victoria Hotel, 7 p.m. "Engineering Problems in the Fenland," by Mr. B. Fletcher.

Apr. 14-18.—Model Railway Club Exhibition, at Central Hall, Tothill Street, London, S.W.1. *The Railway Magazine* Lantern Lectures :—April 15 (*Wed.*), 6 p.m. "Continental Railways," by Mr. W. A. Willox. Apr. 17 (*Fri.*). 6 p.m. "Train Speeds," by Mr. Cecil J. Allen. Apr. 18 (*Sat.*), 3.15 p.m. "The Locomotive as a Prototype for Models," by Mr. J. N. Maskelyne.

Apr. 16 (*Thurs.*).—Manchester and District Traffic Association, at Grand Hotel, Aytoun Street, 7.15 p.m. "Road Transport."

Apr. 20 (*Mon.*).—Royal Society of Arts, John Street, London, W.C.2, 8 p.m. "Problems of Road Research (1)," by Mr. R. Stradling.

Apr. 21 (*Tues.*).—Institute of Transport (Birmingham), at Queen's Hotel, 6 p.m. Annual General Meeting.

Institute of Transport (London), at Inst. of Electrical Engineers, Savoy Place, W.C.2, 6 p.m. "Transport Developments in 1935," by Mr. R. Bell.

Apr. 22 (*Wed.*).—Institute of Transport (Manchester-Liverpool Graduate), at Grosvenor Hotel, Deansgate, Manchester, 6.45 p.m. Annual General Meeting. "British Railway Signalling—Past, Present and Future," by Mr. J. Boustead.

Apr. 23 (*Thurs.*).—Institution of Electrical Engineers, Savoy Place, London, W.C.2, 6 p.m. Kelvin Lecture, by Mr. J. Cockcroft.

Institution of Locomotive Engineers (London), at Inst. of Mechanical Engineers, Storey's Gate, S.W.1, 6 p.m. "The Value and the Necessity of Locomotive Consulting Engineers," by Mr. S. White.

OFFICIAL NOTICES

THE MADRAS & SOUTHERN MAHRATTA RAILWAY COMPANY LIMITED invite Tenders for :—

(*a*) 1,370,000 DOG SPIKES.
(*b*) FIVE LOCOMOTIVE ENGINES AND TENDERS, 4-6-2 SUPERHEATED PASSENGER TYPE "Y.B." (METRE GAUGE).
(*c*) 13 BOILERS FOR LOCOMOTIVES (METRE GAUGE), viz. :—
5 for 4-6-0 Locomotives "MHS" type.
7 for 4-8-0 Locomotives "GS" type.
1 for 2-6-0 Locomotives "YK" type.
1 for 4-6-2 Locomotives "YB" type.
1 for 2-8-2 Locomotives "YD" type.

Specifications and Forms of Tender can be obtained at the Company's Offices, 25, Buckingham Palace Road, Westminster, London, S.W.1.
Fee ONE GUINEA each, *which will not be returned.*
Tenders must be submitted not later than 2 o'clock p.m. on TUESDAY, 28TH APRIL, 1936.
The Directors do not bind themselves to accept the lowest or any Tender and reserve to themselves the right of reducing or dividing the order.

By Order of the Board,
G. W. V. DE RHE PHILIPE,
Secretary.

Bengal-Nagpur Railway Company Limited

THE Directors are prepared to receive Tenders for :—
84 PAIRS ROLLED DISC CENTRED TYRED WHEELS WITH AXLES.
Specification and Form of Tender can be obtained at the Company's Offices, 132, Gresham House, Old Broad Street, London, E.C.2, on or after Friday, 27th March, 1936.
A fee of 10s. will be charged for each copy of the Specification, which is not returnable.
Tenders must be submitted not later than Noon on Wednesday, 15th April, 1936.
The Directors do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right of reducing or dividing the order.

By Order of the Board,
T. R. WYNNE,
Managing Director.

PATENTS for Inventions, Trade Marks, Advice, Handbook, and consultations free. King's Patent Agency, Ltd. (B. T. King, C.I.M.E., Registered Patent Agent, G.B., U.S., and Canada), 146a, Queen Victoria Street, London, E.C.4. 50 years' references. 'Phone City 6161.

Railway Materials & Equipment Manufacturers

ADVERTISER desires active Directorship in an established concern, Birmingham or London Districts. Previous works and selling experience among Home and Foreign Railways. Good connection rolling stock builders, &c. Could probably introduce a strong Sales Organisation if required. Age 45. Audited accounts essential. Capital available, £10,000. Please communicate with DOCKER, HOSGOOD & Co., 10, Newhall Street, Birmingham, in first instance.

OFFICIAL ADVERTISEMENTS.

OFFICIAL ADVERTISEMENTS intended for insertion on this page should be sent in as early in the week as possible. The latest time for receiving official advertisements for this page for the current week's issue is noon on Thursday. All advertisements should be addressed to :—*The Railway Gazette*, 33, Tothill Street, Westminster, London, S.W.1.

The Arrival of the "Queen Mary" at Southampton

(*See illustration on page* 666)

The scene of many events, glorious in the history of man's conquest of the seas, Southampton Water last Friday became the cynosure of all eyes when for the first time the *Queen Mary* made her way up from the English Channel to berth in the new Southern Railway graving dock, named after his late Majesty King George V. Visitors from all parts of the country came to witness the event, and during the subsequent week-end there was a never-ending flow of sightseers passing through the docks.

The entry of the great ship into the narrow opening of the graving dock was a memorable sight, and the vessel's graceful form held the admiration of the beholding multitude which had watched her slow approach through the grey mist. Beside the *Queen Mary*, moored amid others against the new quay and decked in bunting, lay her now deposed sister the *Majestic*. As soon as the liner was finally docked, less than half-an-hour after her arrival, the process of emptying the dock was commenced. By evening the *Queen Mary* was once more high and dry, waiting for a final dry-dock overhaul before setting out on her maiden voyage.

To enable Londoners and others to witness this simple but impressive event, the Southern Railway ran ten special trains to Southampton, and seven steamers took passengers to meet the *Queen Mary* in mid-stream and accompany her up Southampton Water. In addition no fewer than 513 motor vehicles entered the docks during the day.

Saturday was a "local" day, when 2,968 people walked round the graving dock, and 730 motor cars were parked near the docks. On the Sunday the peak was reached, and as many as 18 special trains, bringing 6,986 passengers, entered the docks. They came from amongst other places, London, Brighton, Portland, Weymouth, Bournemouth, Margate, Sandwich, Bristol, Bletchley, Acton, Reading, Harpenden, Swansea, Cardiff, Leicester, Hereford, Wolverhampton, and Birmingham. The G.W.R. was responsible for bringing no fewer than 2,300 people from the Bristol and South Wales areas alone. Local visitors totalled 11,375 and 2,362 motor vehicles were parked. The average time for dealing with the 18 special trains in the shed was 2½ min. All were berthed and cleaned in the docks, engines were turned as required, and the trains subsequently worked to the Central station or Terminus station for the return journeys.

While the crowd was passing round the graving dock, a running commentary, interspersed with musical selections, was relaid through loud speakers from the *Twickenham Ferry* which was moored close by. Special catering arrangements were made at the buffets in the new sheds. A shuttle service of buses was run between No. 8 gate and the concourse of No. 108 shed which are about 1½ miles apart. This helped considerably in expediting the movement of the large crowds.

On Monday, the public interest continued to show itself. Nearly 2,000 people visited the graving dock, and 606 motor vehicles were parked in the New Docks extension. The *Queen Mary* is expected to remain in the graving dock until Tuesday, April 14, and special excursions will be run again this Sunday from London and other centres.

G.W.R. Ambulance Competitions, 1936

The first and semi-final rounds of the G.W.R. annual series of first-aid competitions took place in February and March. The divisional contests, organised in each of the seventeen divisions, attracted an entry of 292 teams, 112 in the advanced class, and 180 in the beginners' class. Handsome trophies are competed for in both classes of all divisions, in addition to which prizes are awarded by the Directors. In the semi-final, the winners in the advanced and beginners' classes of all divisions (34 teams in all) took part, and Dr. S. McCormac, of Newport, and Dr. W. J. Crawford, of Southall, adjudicated in the team test and individual tests respectively. The semi-final round was, for the convenience of the competitors, held at Birmingham, Paddington, Bristol and Newport, and the eight teams selected to take part in the final competition were Fishguard, Gloucester, Liskeard, Swindon A., Swindon B., South Lambeth, Hereford, and Aberdare B. The final competition will be held on May 1, in the General Meeting Room, Paddington, when the teams will contest possession of the Directors' Shield and Carvell Cup, and further prizes will be awarded by the Directors. An interesting feature of this year's final is that two beginners' teams have won a place, Swindon B and Aberdare, and the Henry Butt Bowl, awarded to the beginners' team securing the highest place in the series of competitions, will, therefore, be competed for.

The adjudicators in the final competition will again be Dr. McCormac and Dr. Crawford, and it is hoped that Sir Robert Horne, Chairman of the company, will make the subsequent presentation of trophies and prizes.

Railway Share Market

There has been very little expansion of business in the stock and share markets since the beginning of the new Stock Exchange account on Monday, but Home Railway stocks were reported to be rather more active. The offer made by the railways to replace a further portion of the 1931 wages "cuts" was interpreted in the market as indicating confidence that the improved trend in traffic receipts is likely to continue.

Last week's traffics were again satisfactory, and although the increases were less than had been expected in the market, the aggregate increase for the first quarter of the year can be placed at not far short of £1,000,000, which, all things considered, represents an encouraging achievement. Great Western ordinary was fractionally better. Southern deferred and preferred received a good deal of attention despite the £8,000 decrease in the traffic return. This week's figures are likely to benefit from visitors to Southampton to view the *Queen Mary*. Even allowing for the larger amount to be paid in wages the company is probably earning at the rate of between ¼ per cent. and ½ per cent. on its deferred stock, according to current market views.

L.M.S. ordinary came in for good buying on any reaction, and in this case earnings on the stock are now probably running at the rate of ¾ per cent., allowing for the wages increase. The 1923 preference was favoured by buyers. L. & N.E. preferred and deferred were rather easier, but the second preference was bought on possibilities of a good advance in price later in the year if traffics continue to increase. The first preference was fairly steady. London Transport "C" was fractionally lower.

Foreign railways stocks were again dull. Sentiment continued to be affected by the decision to postpone consideration of dividends on the preference stocks of B.A. Great Southern and B.A. Western, although this had been expected. The ordinary and preference stocks of both railways made lower prices, as did Central Argentine. Cordoba Central debentures came in for profit-taking. Antofagasta was out of favour and Taltal was affected by the decision not to pay an interim dividend. San Paulo was again out of favour, pending the dividend decision. Canadian Pacific was better later in the week.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

	Railways	Miles open 1935-36	Week Ending	Traffics for Week: Total this year	Traffics for Week: Inc. or Dec. compared with 1935	No. of Weeks	Aggregate Traffics to Date: Totals: This Year	Aggregate Traffics to Date: Totals: Last Year	Aggregate Traffics to Date: Increase or Decrease	Shares or Stock	Prices: Highest 1935	Prices: Lowest 1935	Prices: Apr. 1, 1936	Yield (See Note)
				£	£		£	£	£					
South & Central America.	Antofagasta (Chili) & Bolivia	834	29.3.36	11,090	– 2,260	13	177,110	158,710	+ 18,400	Ord. Stk.	23	14 15/16	22 1/2	Nil
	Argentine North Eastern ..	753	28.3.36	7,203	– 721	39	303,209	282,406	+ 20,803	,,	7	4	5	Nil
	Argentine Transandine ..	—	—	—	—	—	—	—	—	A. Deb.	49 1/2	30	47 1/2	8 7/16
	Bolivar	174	Feb., 1936	6,650	+ 50	9	12,150	12,450	– 300	6 p.c. Deb.	13	5	10	Nil
	Brazil	—	—	—	—	—	—	—	—	Bonds.	14	11	14	3 9/16
	Buenos Ayres & Pacific ..	2,806	28.3.36	101,586	– 11	39	3,206,445	2,937,513	+ 268,932	Ord. Stk.	101 1/2	47/8	81/2	Nil
	Buenos Ayres Central ..	190	14.3.36	$83,100	– $8,900	37	$4,192,606	$4,117,900	+ $74,700	Mt. Deb.	21	10	15 1/2	Nil
	Buenos Ayres Gt. Southern	5,084	28.3.36	158,578	– 22,853	39	5,119,075	5,627,569	– 508,494	Ord. Stk.	27	13 1/2	18	Nil
	Buenos Ayres Western ..	1,930	28.3.36	46,945	– 6,278	39	1,732,870	1,726,901	+ 5,969	,,	24	10	14	Nil
	Central Argentine	3,700	28.3.36	107,638	– 21,014	39	4,694,993	4,607,326	+ 87,667	,,	177/8	7	10 1/2	Nil
	Do.	—	—	—	—	—	—	—	—	Dfd.	9	3 1/4	6 1/2	Nil
	Cent. Uruguay of M. Video	273	21.3.36	11,943	+ 1,551	38	412,040	540,340	– 128,300	Ord. Stk.	8 1/2	3	6	Nil
	Do. Eastern Extn.	311	21.3.36	2,116	+ 106	38	76,406	72,345	+ 4,061	—	—	—	—	—
	Do. Northern Extn.	185	21.3.36	1,657	+ 270	38	53,517	39,629	+ 13,888	—	—	—	—	—
	Do. Western Extn...	211	21.3.36	731	– 3	38	33,419	30,135	+ 3,284	—	—	—	—	—
	Cordoba Central	1,218	28.3.36	24,210	– 860	39	1,106,070	1,106,220	– 150	Ord. Inc.	4	1	2 1/2	Nil
	Costa Rica	188	Jan., 1936	11,558	– 5,258	31	92,279	115,867	– 23,588	Stk.	35	30	36	5 9/16
	Dorada	70	Feb., 1936	12,300	+ 1,300	9	25,600	21,500	+ 4,100	1 Mt. Db.	103 5/8	102 1/2	104 1/2	5 1/4
	Entre Rios	810	28.3.36	8,278	– 4,188	39	425,344	485,684	– 60,340	Ord. Stk.	15	6 1/2	9 1/2	Nil
	Great Western of Brazil ..	1,082	28.3.36	7,900	– 100	13	126,100	135,700	– 9,600	Ord. Sh.	1/2	3/16	1/2	Nil
	International of Cl. Amer.	794	Feb., 1936	$491,759	+ $82,680	9	$993,298	$838,555	+ $154,743	—	—	—	—	—
	Interoceanic of Mexico ..	—	—	—	—	—	—	—	—	1st Pref.	1/2	3/32	1/2	Nil
	La Guaira & Caracas ..	22 5/4	Feb., 1936	4,225	+ 825	9	8,650	6,500	+ 2,150	Stk.	8 1/2	8	8 1/2	Nil
	Leopoldina	1,918	28.3.36	18,902	– 1,795	13	235,850	230,363	+ 5,487	Ord. Stk.	8 1/2	2 1/2	7	Nil
	Mexican	483	21.3.36	$254,500	+ $21,600	12	$2,908,900	$2,676,490	+ $232,500	,,	1 1/2	1/4	3/4	Nil
	Midland of Uruguay ..	319	Feb., 1936	8,176	+ 2,203	35	56,312	85,088	– 28,776	,,	1 1/2	1 1/2	1 1/2	Nil
	Nitrate	401	15.3.36	6,615	+ 2,469	11	35,969	30,491	+ 5,478	Ord. Sh.	64/–	42/–	2 1/2	Nil
	Paraguay Central	274	21.3.36	$2,676,000	+ $1,424,000	38	$79,607,000	$40,083,000	+ $39,524,000	Pr. Li. Stk.	80 1/2	60	77	7 13/16
	Peruvian Corporation ..	1,059	Feb., 1936	78,640	+ 15,819	35	616,056	499,646	+ 116,410	Pref.	105/8	67/16	13	Nil
	Salvador	100	21.3.36	¢25,150	– ¢14,450	38	¢723,246	¢761,502	– ¢38,256	Pr. Li.Db.	65	61	65	7 11/16
	San Paulo	153 1/2	22.3.36	27,665	+ 3,202	12	340,041	263,342	+ 76,699	Ord. Stk.	80	35	55 1/2	4 1/2
	Taltal	164	Feb., 1936	4,570	– 695	35	28,485	22,707	+ 5,778	Ord. Sh.	11 1/16	1 1/8	1 1/4	8
	United of Havana	1,353	28.3.36	44,627	+ 4,073	39	877,838	901,906	– 24,068	Ord. Stk.	3 1/16	1	3	Nil
	Uruguay Northern	73	Feb., 1936	807	+ 246	35	6,367	9,007	– 2,640	Deb. Stk.	4 1/2	2 15/16	4 1/2	Nil
Canada.	Canadian National	23,663	21.3.36	646,743	+ 18,518	12	7,143,437	6,784,812	+ 358,625	—	—	—	—	—
	Canadian Northern ..	—	—	—	—	—	—	—	— 4 p.c.	Perp. Dbs.	78 3/8	52 1/2	68	5 7/8
	Grand Trunk	—	—	—	—	—	—	—	—	4 p.c. Gar.	103 6/8	93	102 1/2	3 7/8
	Canadian Pacific	17,260	21.3.36	472,200	+ 45,200	12	5,203,800	4,700,600	+ 503,200	Ord. Stk.	14 1/16	8 3/4	13	Nil
India.†	Assam Bengal	1,329	29.2.36	33,180	+ 215	48	1,157,971	1,309,484	– 151,513	Ord. Stk.	92 1/8	77 1/2	85 1/2	3 1/2
	Barsi Light	202	10.3.36	3,720	+ 1,057	49	134,085	130,185	+ 3,900	Ord. Sh.	105	77 1/2	73 1/2	6 15/16
	Bengal & North Western ..	2,112	10.3.36	80,401	– 6,062	49	1,222,880	1,220,503	+ 2,377	Ord. Stk.	30 11/2	291	30 5 1/2	5 1/4
	Bengal Dooars & Extension	161	29.2.36	3,174	+ 555	48	128,781	143,838	– 15,057	,,	127 1/2	122	125 1/2	5 9/16
	Bengal-Nagpur	3,268	20.2.36	193,425	– 3,742	46	5,690,179	5,314,855	+ 375,324	,,	105	100 5/16	102 1/2	3 7/8
	Bombay, Baroda & Cl. India	3,072	20.3.36	278,700	+ 40,200	51	8,109,150	8,067,450	+ 41,700	,,	115 1/4	110	112 1/2	5 5/16
	Madras & Southern Mahratta	3,230	10.3.36	152,100	+ 2,252	49	5,061,649	5,231,748	– 170,099	,,	128 1/2	113 7/8	115 1/2	7 3/4
	Rohilkund & Kumaon ..	572	10.3.36	17,642	– 3,072	49	245,059	245,852	– 793	,,	294	262	299 1/2	5 5/16
	South India	2,526	20.2.36	102,113	– 16,543	46	3,491,106	3,695,204	– 204,098	,,	119 3/4	104 1/4	106 1/2	7 1/16
Various.	Beira-Umtali	204	Jan., 1936	61,199	– 3,320	17	254,392	245,504	+ 8,888	—	—	—	—	—
	Bilbao River & Cantabrian	15	Feb., 1936	2,152	+ 91	9	3,469	4,310	– 841	—	—	—	—	—
	Egyptian Delta	622	10.3.36	6,198	+ 90	49	238,093	228,250	+ 9,843	Prf. Sh.	2	1 5/8	1 1/4	5 11/16
	Great Southern of Spain ..	104	21.3.36	999	– 1,128	12	13,903	22,283	– 8,380	Inc. Deb.	3 1/2	2	3 1/2	Nil
	Kenya & Uganda	1,625	Feb., 1936	245,527	+ 26,405	9	478,026	459,598	+ 18,428	—	—	—	—	—
	Manila	—	—	—	—	—	—	—	—	B. Deb.	48	36	48	7 5/16
	Mashonaland	913	Jan., 1936	97,871	– 23,922	17	410,904	464,048	– 53,144	1 Mg. Db.	104 1/4	100	103 3/8	4 7/8
	Midland of W. Australia ..	277	Jan., 1936	14,828	+ 1,651	31	98,451	99,125	– 674	Inc. Deb.	98 3/4	93	94 1/2	5 5/16
	Nigerian	1,905	15.2.36	47,940	+ 247	46	1,681,204	1,774,798	– 93,594	—	—	—	—	—
	Rhodesia	1,538	Jan., 1936	180,459	– 15,308	17	756,445	752,419	+ 4,026	4 p.c. Db.	105 1/2	101	105	3 15/16
	South African	13,250	7.3.36	578,555	+ 32,058	49	28,046,983	25,270,988	+ 2,775,995	—	—	—	—	—
	Victoria	4,728	Nov., 1935	823,035	– 25,801	21	3,959,297	3,881,659	+ 77,638	—	—	—	—	—
	Zafra & Huelva	112	Feb., 1936	10,741	+ 219	9	21,230	21,904	– 674	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1/16

† Receipts are calculated @ 1s. 6d. to the rupee. § ex dividend. Salvador and Paraguay Central receipts are in currency.

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the Sterling weekly receipts at the par rate of exchange has proved misleading, the amount being overestimated. The statements from July 1 onwards are based on the current rates of exchange and not on the par value

Electric Railway Traction

Multiple-Unit for Main Lines

THE decision of the Swiss Federal Railways to construct two three-car electric trains suitable for a top speed of 93 m.p.h. raises the question of how far the multiple-unit principle may be applied in future to main-line traction. The results obtained on the Brighton and Eastbourne express services, with start-to-stop speeds up to 58 m.p.h. have indicated that similar stock, with merely detail modifications, will be suitable for operating the traffic on the Portsmouth line, now being electrified. But once away from Britain, it is possible that multiple-unit working will be applied over really long distances, not, perhaps, with the flexible make-up of the Southern rakes, but as set trains of anything from three cars upwards, two or more of which would be coupled together only in times of peak traffic. Austria, Germany, Italy and to a less extent Sweden, Holland and Switzerland, have openings for such trains. Indeed, in Germany and Holland beginnings have already been made in the high-power two-car "elektrische schnelltriebwagen." But with the eventual electrification of the whole route from Berlin to Munich it may be that set trains will be run instead of locomotive-hauled trains of ordinary carriages. An advantage of such trains over long hilly routes like that from Salzburg to the Swiss frontier at Buchs, is that by suitable design they will be able to maintain with safety high speeds on the almost continuous curves, and by reason of the high power-weight ratio will run more quickly uphill. So far as Austria is concerned the main traffic is international, and even when the Salzburg-Vienna line is converted, certain trains, *e.g.*, the Arlberg-Orient express, must be locomotive-hauled to enable passengers to travel between one country and another without change of train. But in countries with much interurban traffic, even over long distances, and where electrification schemes are in being or in contemplation, set trains seem likely to provide a very convenient operating medium in the same way that diesel-electric set trains are now serving non-electrified lines.

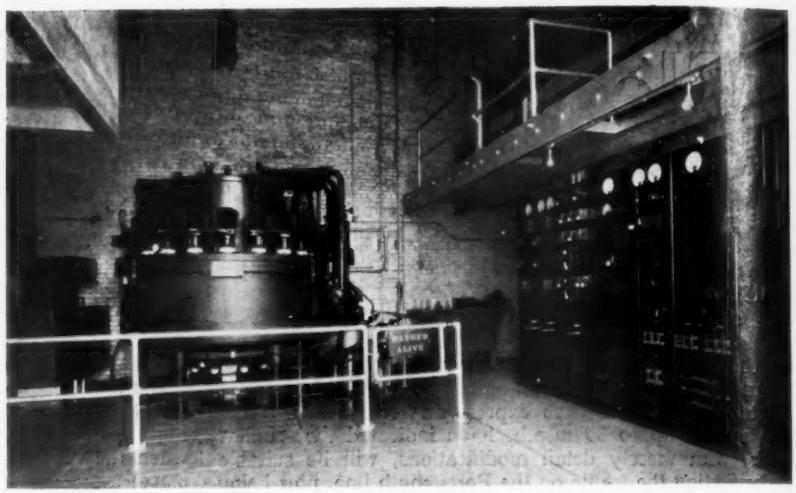
Electric Goods Services

IMPROVEMENTS in goods transport effected by electrification receive less general acknowledgment and publicity than the intensification and speeding up of passenger services. The subject of the electric goods train has, however, been dealt with as far as it touches communications in Sweden by Herr R. Trolle of Stockholm, in a paper read to the Northern Railway Association in Oslo. Herr Trolle's general remarks, and his description of how the Swedish goods services are at present organised, are of interest to other countries beside his own. In addition to improving times of transit by better acceleration, the electric locomotive has expedited the picking up and setting down of wagons, and so has reduced the time occupied at stations. For example, the time occupied at stations by pick-up goods trains on the run from Hallsberg to Gothenburg (160 miles) used to be 706 min., or 714 min. on the return journey, whereas with electric traction the corresponding times are 462 min. and 552 min. This comparison is, however, affected by the fact that some of the shunting formerly carried out by the train engine is now performed by tractors. The gain to electric working is nevertheless evident enough, and is even more so when the running times of pick-up services (exclusive of stops) are considered. More than five hours are saved by electric locomotives between Hallsberg and Gothenburg, the precise time being 374 min., compared with 680 min. and 704 min. for the two directions with steam trains. On the Stockholm-Gothenburg journey (284 miles) the through goods trains, calling only at the largest stations, have reduced the steam train running time of 968 min. to a time with electric traction of 534 min.

The foregoing economies have effected reductions in the hours of duty of enginemen, and also in the number of staff employed per train. Slow goods trains on the Mjölby-Hässelholm run used to be manned by a guard and assistant (two on some sections) and a driver and fireman. On the electric trains the guard requires an extra assistant only at certain parts of the journey, the second man on the engine being able to give all the help needed at most stations. Herr Trolle also gave examples of the striking and sudden change brought about by electric working in the time elapsing between the consignment and delivery of goods. In 1903 a consignment loaded at Stockholm on the first day was available for the consignee at Gothenburg at 7.0 a.m. on the third, and there was no appreciable change in this situation until the present electric timings were introduced on May 15, 1927. These at once made it possible for a consignment to leave Stockholm at 8.0 p.m. and to be ready for collection at Gothenburg at 8.0 a.m. the next day. On the Stockholm-Malmö line electric traction was not introduced until May 15, 1934. In the 1935 timetable the journey was scheduled to be covered in a day, whereas the best timing of 1932 did not give arrival at Malmö until the third day. The best train now has an average speed of 23 m.p.h., compared with 14·3 m.p.h. in the steam service of 1932, at which period it was declared that the engines were being driven too hard. In this brief review of Herr Trolle's paper it has been possible to mention only a few of the improvements worked by electrification in long-distance connections. Intermediate stations have benefited equally, and the Swedish State Railways have found that electric working, with its greater flexibility, simplifies the organisation of services. This was specially felt in 1929, when the interruption of sea transport by ice caused enormous increases of traffic between Stockholm and Gothenburg, and not only were additional facilities provided in a manner that would have been impossible with steam traction, but running times were actually reduced.

RECTIFIER SUBSTATIONS ON THE LONG ISLAND RAILROAD

A brief note on the equipment of one of the busiest third-rail electrified systems in the world, and one which brings the greatest volume of business people into New York



Interior of Manhasset substation showing remote controlled 3,000 kW. mercury arc rectifier

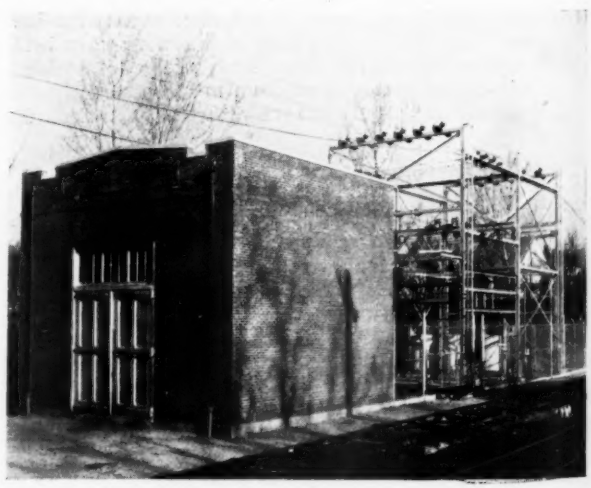
THE Long Island Railroad, a subsidiary of the Pennsylvania, operates a 650-volt d.c. electrified system of 126 route and 376 track miles, which was converted from steam operation between the years 1905 and 1927. This system is operated by well over 800 motor-coaches and about 260 trailers covering approximately 6½ million train-miles a year and carrying about 120 million passengers.

Energy is supplied to the Long Island line through seven substations, each equipped with one 3,000 kW. mercury arc rectifier; one substation containing two 3,000 kW. units; one with three 1,000 kW. units; and one substation with one 1,000 kW. unit, and by the kindness of Mr. F. W. Hankins, Chief of Motive Power of the Pennsylvania Railroad, the following description of this equipment is given.

These substations supply traction power to the 650-volt d.c. third-rail system for multiple-unit and locomotive-hauled trains and operate in parallel on both the a.c. and d.c. sides with rotary converter substations. In one case a rectifier operates in parallel with rotary converters in the same station. All of the rectifier stations are designed for three-phase 25-cycle a.c. supply at 11 or 33 kV. and all except one are either already equipped, or designed to have the necessary auxiliaries added, for dual frequency operation, *i.e.*, 25-cycle or 60-cycle operation as may be desired to suit a.c. system load conditions at the time. All of the substations are unattended and under supervisory control from adjacent rotary converter substations. Both a.c. and d.c. feeders are under supervisory control.

The accompanying illustrations show the general features of the substation layouts. All high-tension equipment, together with the low-tension d.c. negative, is installed outdoors with a steel frame rack to support the h.t. wiring and equipment. The major items of equipment, installed on foundations independent of the rack, are: (*a*) the reactor for use with the 25-cycle supply; (*b*) the three-phase oil circuit-breaker controlling the power supply to the main transformer; (*c*) the main transformer 33 kV. and 11 kV. delta-connected on the h.t. side and double-three-phase-star connected on the l.t. side; (*d*) the inter-phase transformer, which provides the negative d.c. connection and ties the neutrals of the two l.t. windings of the main transformer, thus providing six-phase supply to the rectifier; this is further split by the anode choke coils to supply the 18 anodes of the rectifier.

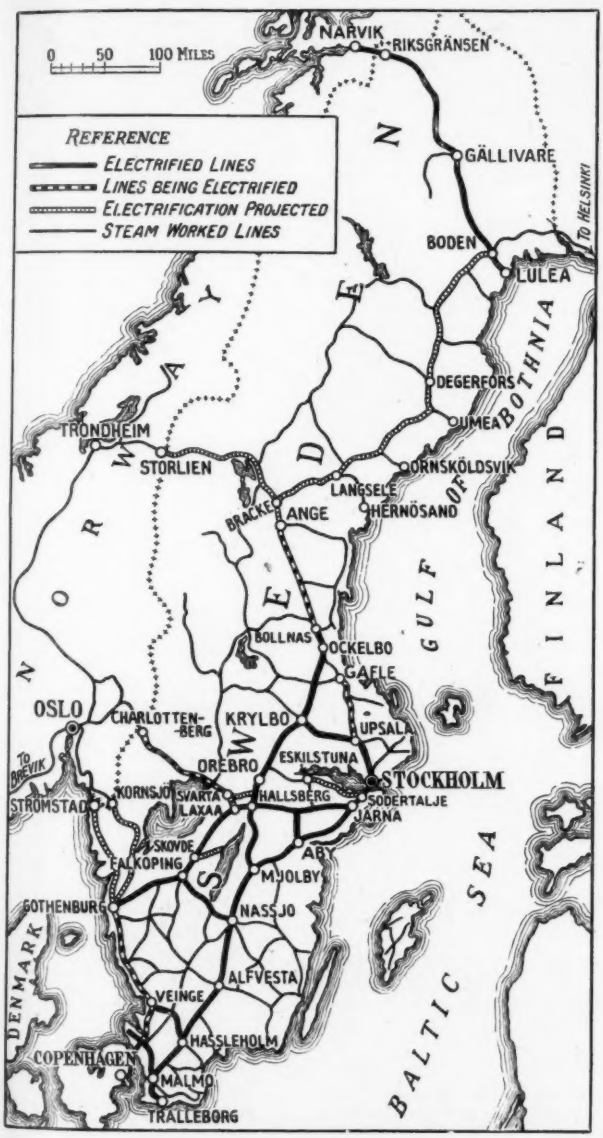
All of the low-tension d.c. positive equipment, together with local and supervisory control and metering equipment, is installed within the building. The major items so installed are (*a*) the rectifier and auxiliaries; (*b*) the control and metering equipment panels; (*c*) the d.c. positive busbar with a high-speed breaker controlling the supply from the rectifier and with the usual lower speed breakers on the individual d.c. feeder circuits from the busbar, all installed on the gallery above the control panels; (*d*) a motor-generator set for supplying the normal 25-cycle control power supply when the station is operating on 60-cycle supply. No troubles of any consequence have been encountered in the operation and maintenance of these substations.



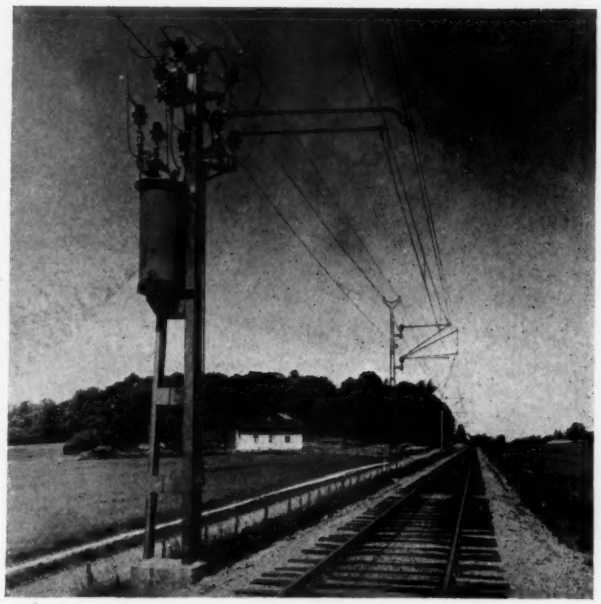
Exterior of Manhasset substation

RAILWAY ELECTRIFICATION IN SWEDEN

SINCE the technical features of the electrified lines of the Swedish State Railways were described in the issue of this Supplement for December 15, 1933, continuous progress has been made in the conversion of further routes, and the total route mileage now electrified at 15,000-volt 16⅔-cycle single-phase is approximately 1,511. This is equivalent to 33 per cent. of the 4,630 miles of the Swedish State system, but as the electrified lines are those with the heaviest traffic, they carry about 70 per cent. of the total train-mileage. The energy consumption for the year 1934 was 260 million kWh. and the price 2·4 ore per kWh., but it is estimated that by the end of 1937 there will be almost 2,000 route miles electrified and the current consumption will then be 430 million kWh. These 2,000 route miles will have cost approximately



Map of Swedish State Railways showing present electrified lines and projected conversions



Mounting of booster transformer on overhead mast

260 million kr. to electrify, and this amount is a slight reduction on the original estimates, as the recent conversion schemes, benefiting from past experience, have been carried out below estimated costs.

The lines of the Swedish State Railways electrified at the beginning of 1936 comprised the following:—

	Approx. route miles
Lapland iron ore railway	279
Stockholm–Gothenburg	284
Jarna–Malmo–Tralleborg, &c.; Katrineholm–Aty	538
Stockholm–Krylbo–Bollnas	197
Krylbo–Orebro	82
Lomma–Halmstad	86
Hassleholm–Veinge	45
	1,511

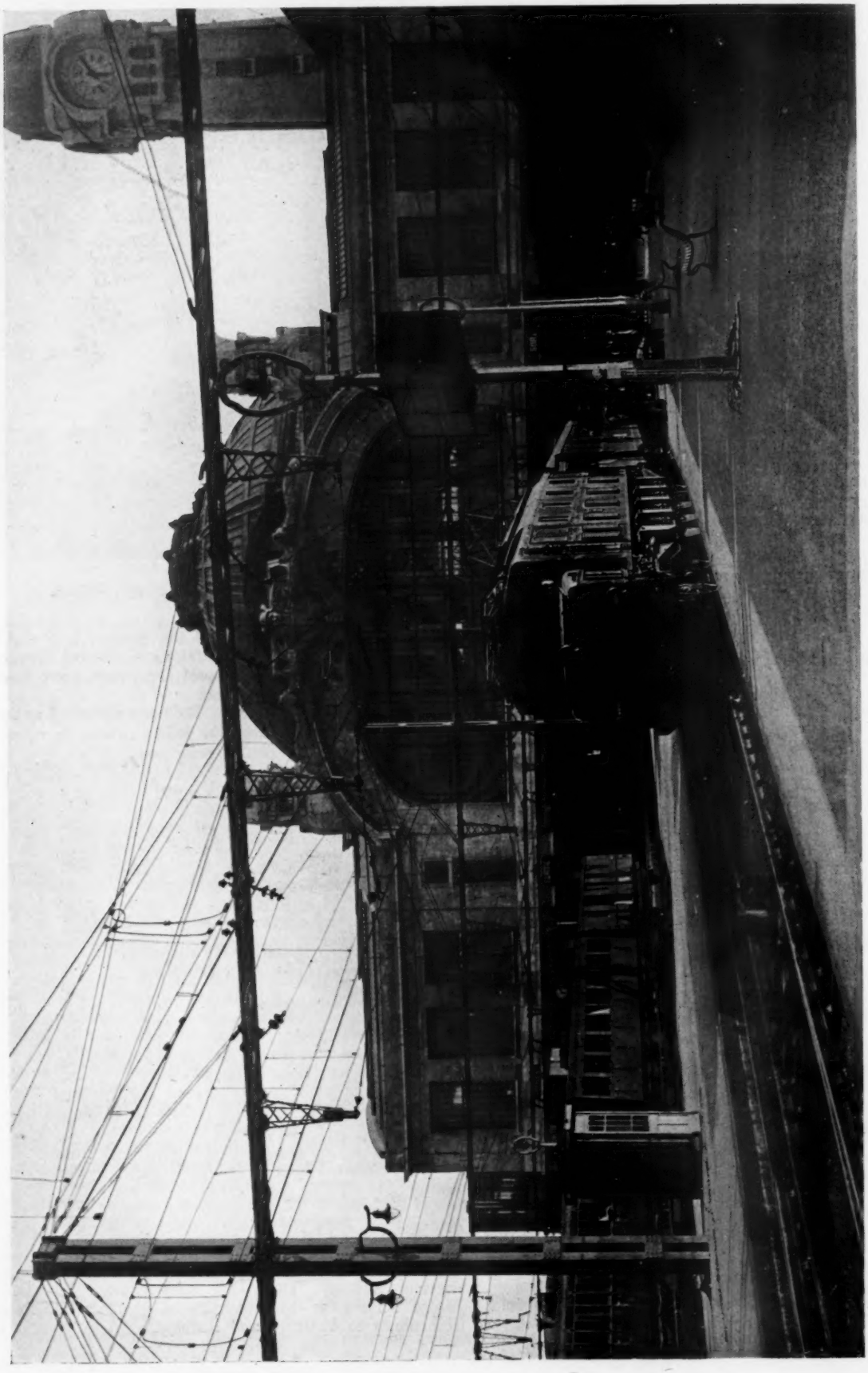
Routes to be electrified by the end of 1937:—

Remainder of Malmo–Gothenburg line ..	156
Astorp–Molle	23
Laxaa–Charlottenberg	131
Sodertälje–Eskilstuna	62
Upsala–Gäfle	71
	443

Lines it is proposed to electrify after 1937:—

Orebro–Svarta	30
Skörde–Karlsborg	28
Skebokvarn–Stalboga	15
Olsbroken–Uddevalla	54
Ange–Boden	410
Bräcke–Storlien	145
	682

In addition to the Swedish State Railways, the Bergslagenas Railway, after long consideration, has now invited tenders for the conversion of its main line from Gothenburg to Mellerud and Kornsjo.

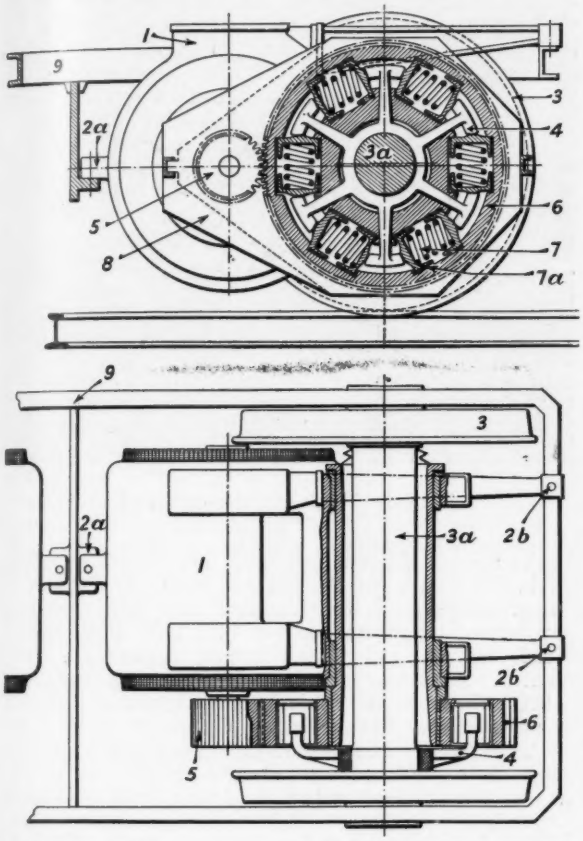


UP PARIS EXPRESS AT LIMOGES STATION, P.O. MIDI RAILWAY

The locomotive is one of the 25 units of 4,000 h.p. with Brown Boveri individual axle drive delivered in 1933-34

A New Individual Axle Drive

FOR application to both spring-borne and nose-suspended traction motors, the Brown Boveri Company, of Baden, Switzerland, has evolved a new type of individual axle drive, the principal feature of which is that the helical driving springs are incorporated in the main gear wheel instead of in the road wheels.



1 - TRACTION MOTOR
2a 2b - MOTOR NOSE SUPPORTS
3 - DRIVING WHEELS
3a - DRIVING AXLE
4 - QUILL SPIDER
5 - PINION
6 - TOOTHED RIM OF GEAR WHEEL
7 - CUSHIONING SPRINGS
7a - SPRING CUPS
8 - GEARCASE
9 - BOGIE FRAME

The accompanying illustration shows the layout of this drive as it was applied to one of the two light-weight high-speed motor coaches for the Swiss Federal Railways, described in the issues of this Supplement for July 27, 1934, and March 8, 1935. These cars have wheels of 950 mm. (37·4 in.) diameter. This type of gear reduces the unsprung weight (the gear wheel and driving springs being mounted on a hollow quill) and also enables standard wheel centres and tyres to be used. The driving spider is formed of arms projecting from a collar on the axle between the road wheel and the gear wheel.

ELECTRIC TRAINS TO LITTLEHAMPTON.—The chairman of the Littlehampton town council is reported to have told the finance committee of that town that he had been authorised to say that the railway to Littlehampton would be electrified in time for the summer season of 1938. The electric service would accelerate the present timing by half-an-hour.

Corrosion in Rectifier Cooling Systems

CORROSION in recirculating cooling systems of steel tank mercury arc rectifiers, used extensively in electric traction, can be successfully combated chemically, and the following notes are based on research work carried out by Messrs. Van Brunt and Remscheid of the International General Electric Company, and published in the *Railway Electrical Engineer*. Recent examination of rectifiers operating in various parts of the U.S.A., using local waters treated with sodium dichromate, has indicated no appreciable general corrosion or pitting during treatment extending in several instances to periods of more than a year. These observations were made on rectifiers which had been previously examined and cleaned periodically when untreated water was used for cooling. A 0·5 per cent. solution of commercial sodium dichromate has been found effective with all waters that are suitable for use as cooling mediums.

Soluble chromates are highly effective passivifying agents; they are not corrosive and consequently can be kept permanently in contact with the surfaces to be protected without danger to equipment. Chromates contain chromic anhydride, CrO_3, which becomes converted into inert chromic oxide, Cr_2O_3, by giving up half of its oxygen. It is thus a strong oxidiser. In this respect it resembles other passivifying agents, which act by producing a film of protective oxide of iron. In common with other oxidants it is also a cathodic depolariser, thereby tending to promote corrosion as does dissolved oxygen; but this latter tendency is successfully combated by the character of its anodic action. The effectiveness of the protective oxide film there produced appears to result not only from the simple production of a film of iron oxide, but also from the remarkable density of the film, arising from the inclusion in it of a portion of the chromic oxide produced by the primary anodic reaction and from the effect of the alkali produced in the immediate neighbourhood by the cathodic action. This last promotes immediate dense precipitation on the anode of the solution which is first formed there, whereas in ordinary corrosion this solution must diffuse away for some distance before a sufficient amount of alkali is encountered to precipitate it, with a resultant loose and non-protective product. Of these factors the inclusion of chromic oxide (Cr_2O_3) is probably the most important as the other actions are also common to other oxidising agents which have less or no protective effect.

It may thus be seen that the dosage of chromate is important. Its effective action logically depends on its presence *at the seat of the reaction* in sufficient concentration to play the rôle described. Where there is local stagnation of the water pitting is probable. Where chromate is used it must be present in the circulating water in sufficient concentration to maintain its protective reactions in such places by sufficiently rapid diffusion. If the concentration is too low, diffusion may be too slow, and in that event pitting may actually be promoted by the chromate because of its depolarising action in surrounding non-stagnant cathodic areas and its effect in increasing the electrolytic conductivity of the water.

FURTHER ELECTRIFICATION IN ITALY.—It is understood that the Bologna-Milan main line, and the lines northward from Milan to the Swiss frontier, as well as the west coast main line from Rome to Leghorn, are to be electrified by 1938. This will provide continuous electric haulage from Reggio, in the south to Domodossolo on the Swiss frontier, a distance of almost 920 miles entirely within Italy.

THE LATEST ELECTRIC RAILWAY IN NORWAY

Tourist line with heavy grades leading down to the Hardanger fjord

THE construction of a railway from Voss station, on the Bergen-Oslo line of the Norwegian State Railways, to Eide, a well-known tourist resort on the Hardanger fjord, was resolved by the Storting in 1919. The final survey was commenced in 1921, and the definite plan adopted by the Storting in 1923, after operations had been commenced as relief works at the end of 1921.

During the construction several amendments to the original plan were proposed; *e.g.*, in 1927 it was proposed in the Storting to postpone for an indefinite period the completion of the railway, and to establish motor transport, partly on the road running parallel, and partly on the finished railway location. The question of the method of working was also made the subject of thorough discussion, and electric traction was finally decided, one reason being the tourist traffic possibilities of the railway. The line was opened to traffic on April 1, 1935.

The length of the line is 27·5 km. (17 miles); the rails are 30 kg. per metre (60 lb. per yd.); the radius of the sharpest curve 180 m. (590 ft.); and the steepest grade 4·5 per cent. (1 in 22). This incline—without any curve compensation—extends over a stretch of 4·5 km. (2·8 miles) between Nesheim and Skjervet, rising in the direction of Voss. For this section of the line a number of alternative methods of construction were submitted during the preliminary investigations, including a location with a spiral tunnel, a line with reversing stations, and a funicular railway. There are five intermediate stations or halts between Voss and Eide.

The cost of constructing the line, including electrical equipment, rolling stock, land and fences, amounted to about 11·5 million kr. A transformer and converting station at Voss takes current from the district power network and supplies it to the overhead contact line on the standard single-phase system of the Norwegian State Railways at 15,000 volts $16\frac{2}{3}$ cycles. This current is further transformed on the cars to 145/600 volts.

Three electric motor-coaches and five light double-bogie driving trailers have been built to operate the line. The motor-coaches have four motors aggregating 630 b.h.p., and the transformers and other electrical equipment are arranged beneath the car body. Current is collected by a single pantograph. In consideration of the heavy grades every endeavour was made to obtain light rolling stock, and by adopting welded steel bogie frame structures and a welded steel body framing with panel plates of aluminium, the motor-coaches tare only 35·5 tonnes. Hand, vacuum, and electric braking systems are incorporated. The bodies contain 80 seats, baggage and postal rooms, lavatories, and a driving compartment at each end. The Norwegian Brown Boveri Company supplied the electrical equipment and the A/S Strømmens Verksted the mechanical portion. The electric braking is on the regenerative system, and a dead-man handle is incorporated.

Interior of light-weight motor-coach

Welded steel bogies and underframes are used for the driving trailers, but in this case the body framing is separated and is made of wood, with aluminium panel plates. The seating capacity is 78 on a tare weight of 22 tonnes and within an overall length of 17·8 m. (58 ft. 8 in.).

Single-phase 630 b.h.p. motor-coach with welded framing and aluminium side panels as used on the Granvin, or Voss-Eide, line of the Norwegian State Railways

Publications Received

Low-Tension Insulators.—Callender's Cable & Construction Co. Ltd. has recently been concentrating, among certain other items, on the production of the Callender-Brown low-tension insulator, which previously had been tested out intensively under a variety of conditions. Designed particularly for installation in the many overhead low-tension systems which have followed in the wake of the grid, this insulator can be used either on poles of normal type or on the special PB-Callender pole or those of the tubular steel type. It is fully described in a brochure (No. 73) to hand from the makers.

Practical Electrician's Pocket Book, 1936. London: Electrical Trading & Electricity, 29, Bedford Street, W.C.2. 5¼ in. by 3½ in. 598 pp. Price 2s. 6d. net.—The maintenance of an up-to-date standard in a pocket book of this size must be no light task, but it is a credit to the publishers and editor that the contents of the 1936 issue appear to represent the latest figures and practice. The work is divided into seven sections, dealing with the principles of electricity; generation; transmission and distribution; wiring; power applications; light current electricity; and lighting and domestic uses. At the end is a useful table giving the supply voltages of electricity undertakings throughout Great Britain. The traction section (railways, trams, and trolley buses) covers 18 pages and gives accurate information regarding modern equipment, but does not include any table of railway electrifications. The only suggestion we would make to render this book more handy is the provision of a thumb index denoting the beginning of each section.

Contact-Line Wear Control on Heavy Electric Traction Systems. By Joseph Voris Lamson. Seattle: Bulletin No. 82 of the Engineering Experiment Station, University of Washington. 34 pp. Price 40 cents net.—In order to obtain useful information on pantograph and contact wire wear within a relatively short time, a special test machine was erected in the laboratories of the University of Washington, and its performance observed under the direction of the author of this bulletin. The machine itself represented as closely as practicable the conditions obtaining on the 3,000-volt d.c. main line of the Chicago, Milwaukee, St. Paul and Pacific Railroad, and the efficacy of the modifications made in the lubrication of the wire and the design of the shoes as a result of the laboratory experiments has been proved on the line in actual service. The Milwaukee line is now using solid graphite lubricant in place of graphite grease, the experiments having shown that the solid lubricant was the most effective. When grease was used, the lubricant was freshly applied to the pantograph shoes at the sheds at each end of a 200-mile division, and the lubrication got worse as the distance from these terminal points increased, until near the centre the wear of the two grooved copper contact wires was 40 mils per 50,000 locomotive passes compared with 8 mils at each end.

The testing machine was set to carry a pressure of 7½ lb. per shoe per wire, this corresponding to the 30-lb. total upward pressure of the pantograph, and the current maintained was 200 amp. per shoe per wire, equivalent to 800 amp. total through the pantograph. Moreover, a mechanism was devised which gave an approximation of the continuous rolling action of a locomotive; it was set first to give 12 oscillations per minute, but this proved too low, and the final adjustment gave 24 oscillations per minute. But the most amazing, if not the most useful, statement in this bulletin is that staggering of the contact wire over the track has been generally disregarded in the U.S.A. In view of this, it seems hard to believe that any great remedy for wire and shoe wear will be found in tackling the lubrication problem, although that problem itself may benefit from researches. The favour shown to a parallel wire is all the more astounding in view of the fact that on curves the chord type of construction (equivalent to a stagger) has been used and the amount of wear found to be only half what it is on straight track.

Extension of Electric Traction on the Mont Cenis Route

WITH the establishment in 1934 of the Marquet plan for the financing of public works in France, a sum was budgeted for the electrification of the 22-mile Culoz-Chambéry section of the P.L.M. main route to Modane, the Chambéry-Modane section of which has been electrically operated since 1930. The two substations at Culoz and Aix-les-Bains were built and equipped at the same time as those for the Chambéry-Modane section, and no more needed to be done than to put the mechanism into working order.

Electric traction came into official operation between Culoz and Chambéry in February, following preliminary tests in December and January last. This portion of line, unlike that from Chambéry to Modane, which has a third rail, except at stations, is fitted throughout with overhead contact catenaries of the Paris-Orléans type, carried in independent supports for each line. No provision has been made for a feeder to augment the catenary sections.

For the 22 miles of newly electrified line, the following equipment was supplied: 1,950 metal pylons and accessories, having a total weight of 1,700 tonnes; 255 miles of wire and cable, weighing 420 tonnes; 15,000 isolators of different types; 270,000 various small parts and 9,300 cu. m. of concrete. The main carrier is a bronze cable with an area of 116 sq. mm. (0·18 sq. in.) and the auxiliary supports are of round copper of 104 sq. mm. (0·16 sq. in.) in section. The contact wires are in hard grooved copper of 107 sq. mm. (0·164 sq. in.) section; their height above rail level is normally 6 m. (19 ft. 9 in.), but in tunnels and at certain other spots it is reduced to 4·6 m. (15 ft. 1 in.).

The overhead lines of the two tracks are independent of each other, and each supported by a sequence of pylons, but special arrangements have been adopted in the two marshy zones bordering the Rhone near Culoz, and round Chambéry. In these districts, on account of the settling of the permanent way, periodical overhauls have to be undertaken each year to maintain the track and see that the line is kept true in alignment and level, and as the same must now be done to the overhead line the supports are portico-shaped over the line, with a wide overhang. It is also possible to regulate their height above the foundation blocks.

The substation at Culoz is fed with 40,000-volt current supplied by the Société Générale de Force et Lumière. The Aix-les-Bains substation is linked up at Chambéry with the high-tension line of the Chambéry and Modane substations which receive current from the Société d'Electro-Chimie, Electro-Métallurgie et des Aciéries Electriques d'Ugine.

NOTES AND NEWS

Bakerloo Anniversary.—Just over 30 years ago, on March 10, 1906, the Bakerloo tube, or the Baker Street & Waterloo Railway to give it the proper title, was opened to traffic. Between 20,000 and 30,000 passengers a day were carried at the beginning, compared with 170,000 nowadays.

New York Traffic.—During the fiscal year ending June 30, 1935, the rapid transit lines in New York carried 598,235,501 passengers, a decrease of 1·4 per cent. compared with the previous year, and 16·3 per cent. less than in the peak year of 1929-30. The total car miles operated in 1934-35 was 99,149,276.

Drumm Battery Trains.—At the recent annual meeting of the Great Southern Railways, Ireland, the chairman, Sir Walter Nugent, Bt., said that they had carried out all the trials of the Drumm trains which they were asked to carry out. They were now in negotiation with the Government and the Drumm people with regard to extending those trains.

Rolling Stock for Wirral Lines.—The electric stock required for the L.M.S.R. lines now being converted in the Wirral peninsula is to be of the three-car articulated type, according to the present proposals. The seating capacity will be approximately 24 first and 176 third class within an overall length of 181 ft. The articulation is to be of an unusual type with two pivots on the articulation bogies instead of the normal one.

Electrification Saves Coal.—Over the Rome-Florence lines, served by 80 trains a day, covering a distance of 23,000 km. (14,260 miles), electrification has brought about a coal saving of 150 tons a day. On the Rome-Naples line, served by 40 trains daily, the fuel economy works out at 30 tons daily, and for the Rome-Nettuno and Rome-Sulmona sections the daily saving is 3 and 24 tons respectively. The total daily fuel saving thus amounts to 207 tons.

Italian Motor-Coaches.—Some new double-bogie motor-coaches (Type E. 24) have been built by the Italian State Railways for stopping services on the 3,000-volt d.c. lines. They seat 69 passengers on a tare weight of 64 tonnes, and are powered by four nose-suspended traction motors wound for 1,500 volts, which have a continuous rating of 147 kW. and a one-hour capacity of 188 kW. The weight of each motor is 2,325 kg. (5,150 lb.). Other single-unit and triple-car sets for solo operation are under construction.

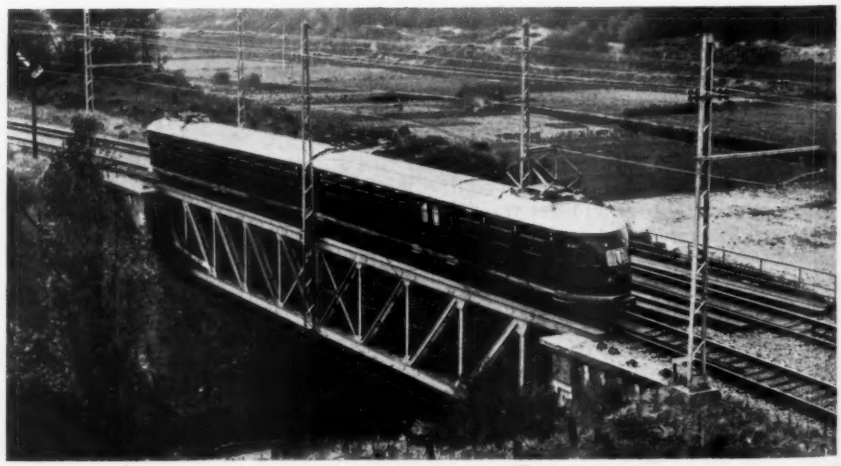
French Electric Locomotive Mileage.—Up to November 30, 1935, electric locomotives Nos. E.501 and E.502 of the P.O.-Midi Railway had covered an aggregate of 1,418,956 km. (880,000 miles). These machines were placed in service in 1927. Locomotives E.503 to E.537, which went into service in the summer of 1933, have built up a kilometrage per locomotive of 226,267 (140,000 miles), and in normal service conditions the average monthly total of each locomotive is about 15,000 km. (9,300 miles).

Modern Trains for New York.—Orders have been placed by the New York Rapid Transit Corporation for the construction of 25 light-weight five-car trains, similar in general design to the trial sets built in 1934 by the E. G. Budd Manufacturing Company and the Pullman Car & Manufacturing Company. The new trains will be delivered during 1936 and will be suitable for operation over the subway and elevated lines. The Rapid Transit Corporation has been authorised by the Transit Commission to issue $2,700,000 of its First and Refunding Mortgage 6 per cent. sinking fund gold bonds to pay for these trains, and to sell these bonds to the Depreciation Fund Board.

NEW NETHERLANDS ELECTRIFICATION PROGRAMME

THE Netherlands Railways have announced a big programme of electrifying by 1938 the lines from Amsterdam to Utrecht ; Utrecht to Arnhem ; Utrecht to Eindhoven ; Utrecht to The Hague ; and Rotterdam to Gouda, totalling approximately 157 route miles. The decision has been influenced by a reduction in the cost of energy and by the successful performance of the streamlined trains introduced last year and described in the issue of this Supplement for November 15, 1935, the current consumption of which per ton-mile is 15 per cent. less than that of the standard multiple-unit trains.

As with the existing electrified system, 1,500-volt d.c. will be used, and the energy will be obtained from the private companies already supplying the traction requirements of the Netherlands Railways. It is expected that about 14 new sub-stations will be erected, and these will probably be of the mercury rectifier type. Present intentions are to run through trains every hour to Eindhoven and Arnhem, alternate trains originating at Amsterdam and Rotterdam. These services and the numerous shorter distance and stopping trains will be worked by 53 two-car and 37 three-car articulated sets. Goods traffic is to be operated by steam traction, and presumably steam locomotives will be retained to haul the through international trains.



Two-car train on the 1,500-volt d.c. electrified lines of the Netherlands Railways